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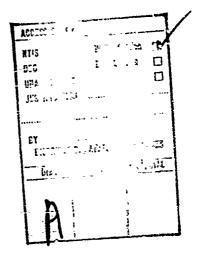
PLANE STRAIN FRACTURE TOUGHNESS (KIC) DATA HANDBOOK FOR METALS

ARMY MATERIALS AND MECHANICS RESEARCH CENTER

DECEMBER 1973

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ABSTRACT

A compilation of plane strain K_{IC} data is presented for metals manufactured in the USA and Europe, including 50 steels, 21 titanium alloys, 38 aluminum alloys, and one beryllium material. The data corresponds to static loading in neutral laboratory environment. The effect of temperature is included in the tables along with the direction of testing, the form and size of the material, its composition and heat treatment, and the specimen type and size. (Author)

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INTRODUCTION

The plane strain fracture toughness values presented in this compilation are expressed in terms of linear elastic fracture mechanics. These $\rm K_{IC}$ values have been obtained by the ASTM E399-72 "Standard Method of Test for Plane Strain Fracture Toughness Testing of Metallic Materials" or a similar method. This data compilation includes materials manufactured in the USA and Europe. The following factors are involved in the selection and interpretation of the $\rm K_{IC}$ values.

Testing Conditions

The material values shown correspond to quasi-static loading of approximately one to three minutes duvation. The environment is a neutral laboratory environment in which no aggressive chemicals or extreme of humidity are intentionally introduced.

Specimen Types

 $K_{\rm IC}$ values shown have been obtained from ASTM recommended bend and compact tensile specimens and from a variety of other specimens: four-point bend, double cantilever beam, wedge opening loading, side edge notched, center cracked specimens and a few double edge cracked and notched round specimens. Surface cracked specimen data is not included in the appendix since, although this configuration is extremely important in applications, criteria for validity of $K_{\rm IC}$ measurements of surface cracked specimens have not been established.

Criteria for Validity of Typics.1 K_{IC} Values

The ASTM E399-72 requirements are taken as the general guide for validity. However, since complete details of factors cited by ASTM are usually not available, personal judgment must be exercised. For example, although all data listed pertain to fatigue-cracked specimens, the range of imposed $K_{\rm I}$ during fatiguing is usually not reported. In addition, the crack front curvature and the orientation of the crack plane with respect to the loading axis are also unknown. Other typical unknowns are the critical crack length, the details of selection of the critical load value, the appearance of the fracture surfaces, the details of fixture design to minimize friction and the linearity of the displacement gage. Therefore, it is often necessary to assume that in general the test measurements have been carried out according to good practice. In terms of specific criteria for inclusion in this tabulation the ASTM requirement of thickness greater than 2.5 $(K_{\rm IC}/\sigma_{\rm YS})^2$, was applied. Virtually all of the data satisfied this requirement. Although it would be desirable to require that crack length exceed 2.5 $(K_{\rm IC}/\sigma_{\rm YS})^2$, this criterion was not rigidly imposed. The minimum reported crack length for data presented in this appendix is 1.25 $(K_{\rm IC}/\sigma_{\rm YS})^2$.

Accuracy of KIC Values

In general the $K_{\rm IC}$ values shown are averages of several tests. The range of typical data may be interpreted to be the average shown ±10%. In cases where the range of toughness values was large, either the entire range is shown or the extremely high values were excluded before computing the average. It should be recognized that these accuracy limits refer only to the specific results obtained and may not be appropriate in general for material of the same nominal composition, form, and size which is processed and tested elsewhere.

Parameters Influencing KIC

Where available, the influence, whether significant or negligible, of material form and thickness, composition, heat treatment, testing temperature and material anisotropy and yield strength upon K_{IC} is shown by the series of data entered in the tables. In most cases where a particular heat treatment produces both the highest yield strength and toughness, data for other heat treatments are omitted. It is important to note that for some materials, data from the combination of composition and processing which leads to the highest toughness is not included in this compilation. In those instances it is not possible to obtain valid K_{IC} measurements for the particular material thickness of interest. There are additional parameters which may also influence K_{IC} values which are not shown in these tables since they are rether infrequently reported. Those include melting practice, heat treating practice such as forging.

DEFINITION OF SYMBOLS AND UNITS

Units, Symbols and Nomenclature

Data is presented in the customary units used in the United States with accompanying International System Units (SI) in parentheses. The definition of units and symbols for specimen orientation and type are given preceding the tabulations.

Composition and Heat Treatment Codes
Code Form: Letter, Number
Letter - Identifies Composition
Number - Identifies Heat Treatment
Letailed Jescriptions of composition and heat treatment are at the bettom of each table. The
compositional values are measured values in terms of percentage by weight, except when designated
ppm (parts per million).
When only specified composition is available, the nominal specified levels are followed by the
letter "N" and the maximum levels of other elements are followed by "f".

b) Orientation of Specimens

Code: First letter: Direction of Loading

Second letter: Direction of Crack Propagation

- Direction Parallel to Primary Grain Flow Direction of Plate, Forging or Extrusion
- Direction Parallel to Largest Dimension in Plane Transverse to L Direction Direction Parallel to Smalle: Dimension in Plane Transverse to L Direction
- ST4: Birection 45° Between Directions of Largest and Smallest Dimension in Plane Transverse to L

Direction

- Radial Direction
- Circumferential Direction If a direction is ambiguous in terms of two of the above definitions, then both directions are shown.
- c) Specimen Identification

Bend: 3-point Bend Specimen Bend (4 pt): 4-point Bend Specimen

ASTM Compact Tensile Specimen CT:

WIL:

Similar to CT, but with different dimensions Remotely Loaded Flat Tensile Specimen with Center Notch cc: Remotely Loaded Flat Tensile Specimen with Double Edge Cracks Remotely Loaded Flat Tensile Specimen with a Single Edge Crack DEC: SEN:

NR: Round Tensile Specimen, Circumferentially Notched

DCB: Double Cantilever Beam Specimen

d) Units

Temperature: F - Degrees Fahrenheit

K - Degrees Kelvin

KSI - Kips per Square Inch NN/m² - Mega Newtons per Square Neter

KSI √in - Kips per Square Inch Times Square Root Inches NN m^{-3/2} - Mega Newtons times (Meters)^{-3/2} Stress Intensity:

Length:

in, mm - Inches, Millimeters

ft, m - Feet, Meters

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Steel, Saw Alloy: AISI 4330M, EN30B	EN30B			Table 1						
	Compo-				Typical	/K1C\ ²	-	Specimen		
Porm	Heat Treat-	Test Orients-	Temp	Yield Strøngth KSI (AN/m ²)	$\left \begin{array}{c} \text{"IC} \\ \text{xSI}\sqrt{\text{in}} \left(\frac{3}{\text{N2V}}\right) \end{array}\right $	2.5 (%)	Thickness Type in (m)	Width in (mm)	Crack Length in (mm)	, <u>ž</u>
AISI 4338M Cylindricul Forging	۸,1	3-5	70(294)	181 (1248)	120(131)	1.10(27.9)	0:1	(25.4) 2.75(69.8)		Ţ-
15.5 in. (394 mm) 00 6.5 in. (36.5 mm) 10	Λ,1	C-R	-20(244)	:	120(131)	÷		(25.4) 2.75(69.8)	;	,
Muon (m /101) 11 cc	Λ,2	C-R	70(294)	157(1/~ 3)	120(131)	(,47(37.3)		(25.4) 2.75(69.8)	i	
	А,2	g-1)	-60(222)	:	45(49)	;	WOL 1.0 (25.4) 2.75(69.8)	, 2.75(69.8)	;	
Plate: 1 in. (25.4 mm)	8,3	L-1	70(294)	210(1448)	\$\$(en)	0.17(4.3)	SR D.	0.353(19.9)	;	7
		T.:I	-160(200)	;	40(44)	1	NK D.	0.353(19.9)	:	_
Forging: 3 in. (36.2 mm)	c, 4	L-1	70(294)	198 (1365)	84(92)	0.45(11.4)	Bcnd0.48 (12.2)'1.5	(38.1)0.3	3 (7.6)	30
		L-T	-63(219)	;	64(70)	;	4pt Bend0.48 (12.2)1.5 4 pt)1.5 (38.1)0.3	3 (7.6)	 -
Bar: 0.56 /n. (14.2 mm)	0,5	L-ST	70(294)	198(1365)	68(75)	0.295(7.5)	Bend0.313(7.8) 0.5		(12.7)0.25 (6.4)	v
o train	0,6	I,-ST	70(294)	207 (1427)	65(72)	0.247(4,3)	Bend0.315(8.0)	0.5	(12.710.26 (6.6)	
	0,7	L-ST	70(294)	216(1489)	\$6(62)	0.168(5.3)	Bend0.315(8.0) 0.5		(:2.7)9.21 (5.3)	
	B,8	r-sr	70(294)	232(1600)	74(81)	0.254(6.5)	Bend0.315(8.0)	0.5 (12.7)0.25	25 (6.4)	
	0.0	L-ST	70(244)	243(1710)	68(75)	0.188(4)	Bend0.315(8.0)	0.5 (12.7)0.22 (5.6	22 (5.6	
HEAT TREATMENT					COMPOSITION	9				
1. 1550F (1117K) 311 Quench; Temper 1050F (839K), 4 HR 2. 1550F (1137K), 5alt Quench to 600F (589K); Temper 1050F (839K), 4 Hr 3. 1700F (1200K), 1 Hr, 0il Quench; Temper 600F (589K), 1 Hr, Air Cool 4. 1275F (1130K), 1 Hr, 0il Quench; Temper 500F (533K), 3 Hr, Air Cool 5. Hot Rolled, Air Cooled; 1525F (1103K), 1 Hr, 0il Quench; Temper 39IF (473K), 1 Hr 6. Heated at 54F (30K)/sec to Ac3 Temp, Quench; Temper 66IF (623K), 1 Hr 7. Heated at 54F (30K)/sec to Ac3 Temp, Quench; Temper 66IF (625K), 1 Hr 8. 1796F (1253K), 1 Hr, Quench in Lead Bath 93IF (773K); Ausformed, 701 Reduction, Air Cooled; Temper 39IF (473K), 1 Hr. 9. 1796F (1253K), 1 Hr, Quench in Lead Bath 93IF (773K); Ausformed, 701 Reduction, Air Cooled; Temper 39IF (473K), 1 Hr.	Jil Quench; Temper 1050F (839K), Salt Quench to 600F (589K); Temp 1 Hr. 0il Quench; Temper 600F (5. 1 Hr. 0il Quench; Temper 500F (5. Cooled; 1525F (1105K), 1 Hr. 0il 30K)/sec to Ac3 Temp, Quench; Temper 750K, sec to Ac3 Temp, Quench; Temper 750F (672K), 1 Hr. 1 Hr. Quench in Lead Bath 931F (7.	589K); Tem 589K); Tem 589K); Tem 50 cor 500F 61, 1 Hr, 0 64 cench; T 64 cench; T 64 cench; T 64 cench; T 64 cench; T 64 cench; T 64 cench; T	5alt Quench; Temper 1050F (839K), 4 HR Salt Quench to 600F (589K); Temper 1050F (839K), 1 Hr. 011 Quench; Temper 600F (589K), 1 Hr. Air (1 Hr. 011 Quench; Temper 500F (533K), 3 Hr. Air (2 Cooled; 1525F (1105K), 1 Hr. 011 Quench; Temper (61F (625K), 30K)/ sec to Ac3 Temp, Quench; Temper 66FF (625K), 30K)/ sec to Ac3 Temp, Quench; Temper 59FF (475K), 1 Hr. Quench in Lead Bath 93IF (773K); Ausformed, ppr 750F (672K), 1 Hr. 1 Hr. Quench in Lead 3ath 93IF (773K); Ausformed, 1 Hr. Quench in Lead 3ath 93IF (773K); Ausformed, 1 Hr. Quench in Lead 3ath 93IF (773K); Ausformed, 1 Hr. Quench in Lead 3ath 93IF (773K); Ausformed,	4 HR 19K), 1 Hr, Air Cool 13K), 3 Hr, Air Cool 14conch; Temper 39IF (473K), 1 Hr 17col 19per 66IF (653K), 1 Hr 17col 19per 70K, 1 Hr 17col 19per 70K, 1 Hr 17col 19per 70K, 2 Hr 17col 19per 70K, 2 Hr 17col 19per 70K, 2 Hr	1 Hr CC CS No.	C SI 0.34 0.22 0.31 1.59 0.28 0.36 0.32 0.20	Mn S P 0.50 0.011 0.012 0.80 0.007 0.009 0.49 0.009 0.012	NO NI 12 0.58 3.08 0.40 1.80 09 0.44 1.34 12 0.24 4.09	60 1.15 1.22 1.22	0.03
•				9	v					

Yield Strength II (MN/m ²)	191(1317)	202(1393)	211 (1455)	208(1334)	216(1489)	222(1551)	218(1503)	239(1648)	260(1793)
Si St	191	202	211	208	216	222	218	235	260

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Ref.

Crack Length in (303)

Width in (mm)

Thickness in (mm)

Type

in (man)

(E) <u>e</u> (a)

0.355 (9.0)

72(79) 72(79)

70(294)

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Bar: Vac. Arc. Remolt

35MCD16

Temp *P (*K)

Test Orienta-tion

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Compo-sition, Heat Trest-ment

Steel Low Alloy: 1. 2016, EN4OC

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70(294) 70(294) 70(294) 70(294) 20(294)

A,2 ٨,3

0.318 (8.1)

0.252 {6.4}

67 (74)

Specimen

Table 2

67

9

Bend 0.5 (12.7) 1.0 (25.4) Bend 0.5 (12.7) 1.0 (25.4) Bend 0.5 (12.7) 1.0 (25.9)

0.316 (8.04) (7.1)

74(81) 72(79) 71(78)

0.278

ur,

0.23(5.8) 0.15(3.8) 0.21(5.3) 0.12(3.0)

0.5 (12.7) 0.5 (12.7) 0.5 (12.7) 0.5 (12.7)

Bend 0.313(8) Bend 0.313(8) Bend 0.313(8) Bend 0.313(8)

(4.8)

0.189

(99)09

70(294) 70(294)

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B, 4

Bar: 0.56 in (14.2 mm) sq.

EN4OC

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B, 5

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(3.9)(2.8)0.048 (1.2)

0.152

\$9(65) 55(61) 44(48)

6, 112

317(2186)

8,7 L-R 70(294) (a) Specimen in accordance with ASIM Recommendations.

COMPOSITION

70(204)

(e.5)

0.256

Ni Cr No V S P Al	\$ 3.99 1.69 0.14 0.05 0.009 0.009 0.026 1 0.15 2.98 0.90 0.23 0.013 0.015 5N 4.0N 1.75M 0.45N - 0.03M 0.03M		(1203K), Air Cool; 1606f (1148K), Air Cool; -95f (203K); Temper 75lf (673K), 2 Hr (1203K), Air Cool; 1606f (1148K), Air Cool; -95f (203K); Temper 66lf (623K), 2 Hr (1172K), Air Cool; 1606f (1148K), Air Cool; -95f (203K); Temper 42-f (493K), 2 Hr (1172K), Ail Quench; Teoper 57lf (533K). Hill Hill Air Safe to Acs Teop, Immediate Qunnch to 70f (284K); Temper 57lf (570K), 1 Hr (1253K), 1 dr, Quench in Lead Bath 102lf (823K); Ausformed 70% Reduction, Air Cooled; r 39lf (473K), 1 Hr (Quench in Lead Bath 102lf (823K); Ausformed 70% Reduction, Air Cooled; r 57lf (573K), 1 Hr
뒭	27 0.33 26 0.54 \$M 0.35N		At A 473
SI	0.35 0.27 0.37 0.26 0.35N 0.4H	~	2225"5"5"
Ui	∢ #∪	HEAT TREATMENT	1. 1705 (2. 1705 (3. 1705 (3. 1705 (4. 1850) (6. 1796) (7. 1796) (

	Treat-	Orienta-	Temp		· k	/ X2 /	Thickness		,
	ment	tion	o _F (o _K)	KSI (MN/m²)	KSI√in \my m ²,	in (mm)	in (ma)	-	Ref.
(2.2 mm) Thick	Α,1	L-7	75(297)	243(1675)	40(44)	0.068(1.7) CC	0.085(2.2) 1.75(4.	44) 0.7 (17.8)	54
		L-1	-103(200)	257 (1760)	35(38)	0.046(1.2) CC	0.085(2.2) 1.75(4.	.44) 6.7 (17.8)	
	A,2	L-T	75(297)	(131 (1590)	35 (38)	0.057(1.4) CC	0.065(2.2) 1.75(4.	.44) 0.7 (17.8)	
		<u>F</u>	-100(200)	240(1555)	31 (34)	0.042(1.1) CC	0.085(2.2) 1.75(4.	44) 0.7 (17.8)	
0.5 in (12.7 mm) Thick	B,3	1-J	200(367)	202 (1393)	\$5(60)	0.185(4.7) Bend	0.5 (12.7) 1.3 (25.	5) 0.23(5.8)	1
		L-T	75(297)	212(1462)	34(37)	0.054(1.6) Bend	0.5 (12.7)	5) 0.28(7.1)	
		T-L	75(297)	204 (1407)	32 (35)	0.061(1.5) Bend	0.5 (12.7) 1.0 (25.	5) 0.26(6.6)	
		L-1	-50(238)	216(1489)	23(25)	0.028(0.7) Frend	6.5 (12.7) 1.0 (25.	.5) 0.26(6.6)	
		L-1	-100(200)	228 (1572)	21 (23)	0.021(0.5) Bend	0.5 (12.7) 1.0 (25.	5) 0.23(5.8)	
(25.4 mm) Thick	C,4	L-T	200(367)	198(1365)	81(89)	0.415(10.6) Bend	1.03 (26.2) 0.94(23.	.8) 0.24(6.1)	
		L-1	-50(238)	210(1448)	25 (28)	0.035(0.9) Bend	0.75 (19.1) 0.75(19.	1) 0.15(3.3)	
		L-J	-100(200)	220(1517)	23(25)	0.027(0.7) Bend	1.0 (25.4)	4) } 0.28(7.0)	
In (76.1 cm) Thick	5 , 0	1-1	70(294)	189(1303)	45 (49)	0.142(3.6) Bend 4 pt	0.18 (12.2) 1.5	1) 0.3 (7.6)	**
		٦ <u>-</u>	-65(219)	i	35(38)	Bend 4 pt	0.48 (12.2) 1.5 (38.	1) 3.3 (7.6)	
in (203 mm) Square	E,1	1-L	70(294)	225 (1551)	38(41)	0.071(1.8) Bend	0.75 (19.1) 0.75(19.	1) 0.15(3.8)	12
	ε,2	1-t	70(294)	194(1338)	73(80)	0.35 (8.9) Bend	0.75 (19.1) 0.75(19.	(1:	
						HEAT TREATMENT			
£	ह्य	ଧ	윘	اء	히	1850F	20 min; Temp 20 min; Temp	100F	(839K) (867K)
	0.96 0.90 0.96	5.12 4.91 5.39	1.33			1850F 1080F 1850F	, in Salt, Oil , in Salt, Oil	基基	# #
	H-11, H-11M n (2.2 mm) Thick 2.7 mm) Thick m) Thick 13 mm) Square 6.35 0.35 0.37 0.28 0.40 0.35		Silent Crypo- sttion, sttion, stion,	Stitton, Heat Crapolisation, Heat tion of the tion of	String or float	Table 3 C_mpo.	Table 3 Trable 4 Strength Strength	Trable 3 Trable 3 Trable 3 Trable 3 Trable 3 Trable 4 Trable 4 Trable 5 Trable 5	C

	-CORDO	-00	}		-		Tonical								ſ
	sition,					٧٤٠١٠	Kr	,	x1c / 7	l	S	Specimen		_	_
Form	Heat Treat-		Test Orients- tion	Temp		45 v)	$\left(\frac{1}{\text{KSI}\sqrt{\text{In}}}\left(\frac{1}{\text{MN m}^{-\frac{3}{2}}}\right)\right)$;		ية ع	Thickness in (mas)	width in (mm)	Crack Length in (mm)	, e	
1 in (25.4 mm) Thick	Α,1		L-1	200(367)	4	1	65(72)	1] 6	→	1.03 (26.2)	1.03 (26.2) 1.0 (25.4) 0.321 (8.2)	.321 (8	⊸ i	
	Α,1		1.7	75(297)		196(1310)	(6_);;	0.559	0.359 (9.1)		.03 (26.2)	1.03 (26.2) 1.0 (25.4) 0.225	.225 (5	(5.7)	
	B, 1		T-L	75(297)	:		(77)0_	i		-	.02 (25.9)	.02 (25.9) 1.0 (25.4) 0.3		(9.5)	
	8.1		1-1	-50(228)		200(1379)	65(72)	0,324	0.324 (8.2)	Bend -	.02 (25.9)	1.02 (25.9) 1.0 (25.1) 0.33		(8.4)	
	8,1		۲ <u>۱</u>	-100(200)		205(1413)	\$2(\$7)	0.161	0.161 (1.1)		.02 (25.9)	1.02 (25.9) 1.0 (25.4) 0.24		(6.1)	-
Plate: 1 in (25.4 mm) Thick	C'3		J-L	70(294)		177 (1220)	(66)06	0.782	0.782 (19.9)	N E	.0 (25.9)	1.0 (25.9) 4.5 (114.) 1.6		(40.6) 21	
Plate: 4 in (101.6 mm) Thick	0,3		r-1	75 (297)		66 (455)	(09) \$3	1,736	1,736 (44.1) WOL		1.0 (102)	4.0 (102) 10.22 (260) 4.0		(162) 45	
			L-T	(9~~0		82(565)	\$2(57)	1,005	1,005 (25.5) WOL		(102)	4.0 (102) 10.22 (260) 3.1		(78.7)	
COMPOSITION															
다.	اری درا	Si	왕!	뒮	>1	리									
0.37 0.75 0.38 0.83 0.45 0.98	0.010 0.019 0 0.008 0.025 0 0.013 0.030 0 0.007 0.023	0.26 0.85 0.21 0.91 0.19 1.04 0.13 0.89		0.15 0.17 0.21 0.01	1 0.08	0,25									
HEAT TREATMENT															-
1. Austenitize 1550F 2. Austenitize 1550F 3. Austenitize 1550F	F (1117K) in Salt, Oll Quench, Temper 860F (700K), 2 Dr F (1117K), 1 Hr, Oll Quench, Temper 900F (756K), 2 Hr + 2 Hr, Alr Cool F (1117K), 6 Hr, Oll Quench; Temper 1200F (922K), 6 Hr, Burnace Cool	1t, 011	Quench, Taench, Tench; T	Temper Temper 90 Temper 12	8¢0F (70 OF (756K 30F (922I	0K), 2 Br), 2 Br · 2 (), 6 Br, Pa	Hr, Alr Cool rnace Cool								

STEEL, LOW Alloy: AISI 4140	(Sheet 1 of	£ 2)		Tabte 5							
	-combo-				Typical	/K1C\ ²		Spe	Specimen		
Form	Heat Treat-	Test Orienta-	Temp	Yield Strength KSI (MN/m ²)	$ \begin{array}{c} $	$\frac{2.5 \left(\frac{\alpha}{y_s}\right)}{\text{ir. (mm.)}}$	Type in	Thickness in (mm)	Width in (mm)	Crack Length in (mm)	Ref.
Plate: 0.125 in (3.2 mm)	Α,1	L-T	200(367)	220(1517)	40(44)	0.083 '2.1)	ttc 0.1	0.10 (2.5)	3.0 (75.2)	1.2 (30.5)	8 (
Inter-	۸,2	<u>-</u> .	-100(200)	220(1517)	40(44)	0.083 (2.1)	CC 0.1	0.10 (2.5)	3.0 (76.2)	1.2 (30.5)	
Plate: 0.375 in (9.5 mm)	8,3	1-1	200(367)	208(1435)	(09)09	0.208 (5.3)	Bend 0.390(9.9)	(6.6)06	1.0 (25.4)	0.4 (10.1)	· ·
ועזכע	E,3	1-1	75(297)	226(1517)	\$2(\$7)	0.140 (3.6)	Bend 0.390(9.9)	(6.6)06	1.0 (25.4)	0.4 (10.1)	
	٤,٦	1-1	75(297)	223(1538)	53(58)	0.141 (3.6)	Bend 0.377(9.6)	(9.6)	0.9 (22.9)	0.37 (9.4)	
	e, a	1-1	-50(228)	235(1620)	40 (44)	0.072 (1.8)	Bend 0.390(9.9)	(6.9)	1.0 (25.4)	0.4 (13.1)	
	E,3	L-T	-100(200)	240(1655)	32(35)	0.044 (1.1)	Bend 0.390(9.9)	(6.9)06	1.0 (25.4)	0.4 (10.1)	
Plate: 0.500 in (12.6 mm)	И, 10	1-1	75(297)	231(1593)	(8(75)	0.217 (5.5)	Bend 0.5	Bend 0.500(12.7)	1.0 (25.4)	:	80
Plate: 0.625 in (15.9 mm)	C,4	l. :	75(297)	204(1504)	78(86)	0.371 (9.4)	SEN 0.5	0.523(13.3)	2.0 (50.8)	0.67 (17.6)	21 (
Plate: 1 in (25.4 mm)	8,0	L-T	70(294)	182(1255)	(911)901	0.850 (21.6)	Bend 1.0	(25.4)	2.0 (50.8)	1.0 (25.4)	9
Inter	9'0	1-1	70(294)	213(1469)	68(75)	0.255 (6.5)	Bend 1.0		(25.4) 1.0 (25.4)	0.5 (12.7)	
	B,7	1-1	-50(228)	203(1380)	(12)	0.256 (6.5)	Bend 1.0		(25.4) 1.0 (25.4)	0.2 (5.1)	7
		1-1	-100(200)	206(1400)	\$0(55)	0.148 (3.8)	Bend 1.0		(25.4) 1.0 (25.4)	0.2 (5.1)	
	8, a	1-1	70(294)	230(1586)	\$2(57)	0.128 (3.3)	Bend 0.25 (6.3)	(6.3)	1.0 (25.4)	0.5 (12.7)	6 (
	D,7	1-1	75(297)	206(1400)	80(88)	0.38 (9.7)	Bend 0.95	(24.2)	2.0 (50.8)	1.0 (25.4)	**
Billet: 4x4.5 in (102x	6'9	T-1	72(296)	241(1662)	53(58)	0.121 (3.1)	Bend 0.9	0 (22.9)	0.90 (22.9) 1.8 (45.7)	6.9 (22.9)	- 62 (
Arc Remeited		7.	72(296)	240(1655)	54(59)	0.127 (5.2)	Bend 0.9	0 (22.9)	Bend 0.90 (22.9) 1.8 (45.7)	0.9 (22.9)	
		7-5	72(296)	240(1655)	56(62)	0.136 (3.5)	Bend 0.9	0 (22.9)	Bend 0.90 (22.9) 1.8 (45.7)	0.9 (22.9)	
Forged Bar: 5 in (127 mm)	α,1	T-S	70(294)	191(1317)	80(88)	0.439 (11.1)	(e)		:	;	69
	1,12	1-5	70(294)	230(1586)	49(33)	0.113 (2.9)	(a)		:	;	
(a) Specimen in accordance with ASTM Recommendations	ordance with AS	ТМ Кесопле	ndat i ons	\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-	13<						
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		Crack Length in (wm)										
	Specimen	Width in (Rm)										
	S	Thickness										
		13me										
	$/\kappa_{\rm IC}$	2.5 (0/3) 1n (mm)										
11.)	Typical	$\left \begin{array}{c} IC \\ KSI\sqrt{In} \left(\frac{3}{MN a^{-\frac{3}{2}}} \right) \end{array} \right $										
Tuble 5 (Cont.)	1177	Strength KSI (MN/m ²)										
		ر ا ا		ŞI	0.26	0.36	0.23	0.25	0.22	0.34	0.20	0.30
	 	Temp		٥١	0.78	0.82	0.80	0.79	0.78	0.82	0.84	1.03
5		Test Orienta- tion		긺	1.83	1.85	1.77	1.77	1.87	1.71	1.86	1.56
(Sheet 2 of 2)	Compo- sition,			Si	0.33	0.30	0.25	0.29	0.39	0.25	0.28	0.24
(Shec	8#	<u> </u>		νi	0.009	0.005	0.012	0.010	0.012	0.005	0.002	0.004
1340				اء	0.015	0.010	0.010	0.005	0.018	0.008	0.00	0.013
AISÍ 4				Æ	0.72	0.65	0.71	0.75	0.69	0.84	0.74	0.63
\110y:		Form	•.	ن ان	0.41	0.43	0.42	0.40	0.41	0.45	0.38	0.43
STEEL, Low Alloy: AISI 4340			COMPOSITION		< =	Ü	a	Ľ1	LL (: ت	Ξ.	-
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HEAT TREATMENT

Normalize 1600F (1144K), 1 Hr; Austenitize 1550K (1117K), 1 Hr, 0il Auench; Temper 1 Hr, 400F (478K)

2. Normalize 1600F (1144K), 1 Hr, Austenitize 1550F (1117K), 1 Hr, Oil Quench; Temper 1 Hr, 700F (664K)
3. 1550F (1117K) Salt; Oil Quench; Temper 1 Hr + 1 Hr, 500F (533K)
4. 1550F (1103K), 1 Hr; Temper 1 Hr + 1 Hr, 700F (644K)
5. 1500F (1089K), 0.5 Hr; Oil Quench; Temper 1 Hr, 925F (770K)
6. 1500F (1089K), 0.5 Hr; Oil Quench; Temper 1 Hr, 750F (672K)
7. 1550F (1117K) Salt, Oil Quench; Temper 1 Hr, 1 Hr, 800F (700K)
8. 1500F (11089K), 0.5 Hr, Oil Quench; Temper 1 Hr, 600F (589K)
9. 1550F (1117K), 1 Hr, Air Cool; 1550F (1089K), 1 Hr, Oil Quench; -321F (77K), 0.5 Hr Min; 400F (478K), 2 Hrs Air Cool; 1550F (1089K), 0.5 Hr, Oil Quench; -320F, 0.5 Hr, Alr Cool; 1547K), 0.5 Hr, Air Cool; 250F (394K), 24 Hr, Air Cool; 250F (1138K), 0.5 Hr, Oil Quench; Temper 841F (723K), 0.75 Hr
12. 1543F (1113K), 0.5 Hr, Oil Quench; Temper 571F (573K), 1 Hr

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STEEL, LOW Alloy:	A110y: 300M	(Sheet 1 of 2)			Table 6							
		-odabo-				Typical	/K _{1C} \ ²		S	Specimen		
		sition, Heat	Test	ŧ	Yield Strength) - -	3 2.5 (%)		Thickness	Wideh	Crack	
	Form	Treat	Orienta	• F (*K)	KSI (MN/m²)	$KSI\sqrt{fn} \left(MN = \frac{7}{N}\right)$	z/ in (m)	38	in (m)	in (m	7	2
Forging:	in (152	× A,1	L-T	70(294)	246(1703)	(57)69	0.195 (5.0)	Bend	:	:	ŧ	6
Forging:	254 mm/ 4.5 x 4.5 in (114 x 114 mm) Vac. Arc Remeit	B , 2	7	70(294)	243(1675)	(65)	0.152 (3.9)	Bend	Bend 0.50 (12.7) 1.0 (25.4)	1.0 (25.4)	0.5 (12.7)	91
Forging:	1 x 13 x 34	C,5	L-T	70(294)	240(1655)	88 (96)	0.336 (8.5)	ઇ	0.372(9.4)	5.0 (127)	1.90 1.90	22
	in (25.4 x 330.2 x 863.	C,4	T-1	70(294)	234(1613)	74(81)	0.250 (6.4)	ខ	0.370(9.4)	5.0 (127)	2.05 (52.1)	
	6 mm)	5,5	T-7	70(294)	205(1413)	74(81)	0.326 (8.3)	ខ	0.370(9.4)	5.0 (127)	1.75 (44.4)	
Forging:	3 x 9 in (76.2	9,d	T-L	70(294)	233(1606)	79(87)	0.287 (7.3)	Bend	0.480(12.2) 1.5 (38.1)	1.5 (38.1)	0.30 (7.6)	•
	x 229.6 mm) Hot Rolled 2300F (1533K) Forged 2100F		1-1	-65(219)	233(1606)	53(58)	;	Bend A pt	4 pt Bond 0.480(12.2) 1.5 (38.1) 4 pt	1.5 (38.1)	0.30 (7.6)	
Forging:	20 in (508 mm)	E,6	T-L	70(294)	236(1627)	68 (74)	0.208 (5.3)	Bend	Bend 0.480(12.2) 1.5 (38.1)	1.5 (38.1)	0.30(7.6)	
	dia ingot Forged at 2125F (1436K) to 3 x 9 in (76.2 x	tı.	T-L	-65(219)	;	45(49)	:	Bend Prof	# pt 4 pt	1.5 (38.1)	0.30 (7.6)	
Billet: 3	228.0 mm.) 3 in (76.2 mm)	F,7	L-TS	76(294)	142(976)	111(122)	1.33 (38.8)	(a)	:	ŧ	1 1 1	ŭ
		8,17	L-TS	70(294)	185(1275)	111(122)	0.9 (22.9)	(a)	:	:	i	
		6,7	L-TS	70(294)	206(1418)	78(86)	0,358 (9.1)	(a)	:	:	:	
Bar: Vacu	Vacuum Arc Re- melted 1 in (25.4 mm) Dia	F,10	7-R	70(294)	238(1643)	68(75)	0.209 (5.3)	e	:	:	:	67
Forged Bas	Forged Bar: Vac Pemelt 5 in (127 mm) Dia	6,11	ڻ- د	70(294)	255(1755)	45(50)	0.078 (2.0)	3	:	! !	:	6
Billet:	4 x 4.5 in	Н, 12	T-7	72(296)	259(1785)	52(57)	0.101 (2.6)	Bend	Bond 0.9(22.9) 1.8 (45.7)	.8 (45.7)	0.9 (22.9)	2
	(101 × 114 mm)		1-1	72(296)	255(1758)	56(62)	0.121 (3.1)		Bend 0.9(22.9) 1.8 (45.7)	.8 (45.7)	0.9 (22.9)	20
			1-1	72(296)	255(1758)	58(64)	15 € 129 (3.3)		Bend 0.9(22.9) :.3 (45.7)	.3 (45.7)	0.9 (22.9)	79
S (8)	pecimen in acco	(a) Specimen in accordance with ASTM Recommendations	seconmendat	ions								

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300M (Sheet 2
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STEEL, LOW	LOW Alloy:	300M		(Sheot 2	2 of 2)					Table 6 (Cont.)	ont.)							
					Compo-	0 E		L		Yield	۲	lypical Kro	/K1C \2		Sp	Specimen		
	ir.	Form		,	Heat Treat-		Test Orienta- tion	decl 9,	(X)	Strength KSI (MM/m ²)		$\operatorname{KSIVIn}\left(\frac{3}{\mathrm{KN/m}^{-\frac{3}{2}}}\right)$	$2.5\left(\frac{1}{9}\right)$ in (mm)	Type	Thickness in (mm)	Width in (mm)	Crack Length in (mm)	Ref
Plate: 0	0.56 in (14.2 mm) Thick	(14.2	<u>(</u>	ick	3,13	2	L-T	70(294)	94)	248(1710)		÷۱۱(وو)	0.146 (3.7)	Bend 0.	Bend 0.5 (12.7)	1.5 (38.1)	*	123
					3,14		7.	70 (294)	94)	233 (1606)	9	60(72)	0.2(5.1)	Bend 0.	Bend 0.5 (12.7)	1.5 (38.1)	•	
COMPOSITION	IQN																	
	υI	ಪ	된	s)	۱۵		푀	٥l	>1	VI								·—
くね ひるmmcmヵ	000000000 44460000000000000000000000000	1.68 1.77 1.60 1.55 1.62 1.63 1.59	0.70 0.81 0.83 0.85 0.73 0.81 0.80	0.003 0.003 0.006 0.006 0.006 0.006 0.006	0.010 0.007 0.007 0.014 0.009 0.005 0.006	0.39 0.43 0.43 0.37 0.37 0.37	28 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0.79 0.83 0.85 0.94 0.98 0.79	0.09 0.09 0.09 0.09 0.09 0.09	0.15								
HEAT TREA	TREATMENT																	
1.5 w.4.0.5.000015 84	1600F (1144K), 1700F (1200K), 1700F (1200K), 1700F (1200K), 1700F (1200K), 1700F (1200K), 1700F (1200K), 1700F (1203K), 1700F (1203K), 1700F (1200K), 1500F (1170K), 1600F (1144K),	(1144K), Quenched (1200K, 3 1/2 ifr, (1200K), 1 1/2 ifr, (1200K), 1 1/2 ifr, (1200K), 1 1/2 ifr, (1200K), 1 1/2 ifr, (1203K), Air Cool; (1203K), Air Cool; (1100K), 2 + 2 ifr (1117K), Oil Quench (1144K), Oil Quench	3 1/2 ifr. 1 10F 1/2 ifr. 1	mched Mar 2 if, Alra 1, 1/2 if, Al 1, 2 if, Al 2 if, Al 1, 0il Qu Cool; 17 Cool; 18 Cool; 19 Cool; 10 Cool; 10 Cool	Quenched Marm Oil; Double Temp 1/2 ifr, Air Cool; 1600F (1144) 110F, 1/2 Hr, Double Tempered 11/2 Hr, Air Cool; 1600F(1144) 11/2 Hr, Air Cool; 1600F(1144) 11/2 Hr, Air Cool; 1600F(1144) 11/2 Hr, Oil Quunched; Double Temp Air Cool; 1777F (1243K), Oil Q Air Cool; 1615F (1153K), Oil Q 1 Hr, Air Cool; 1600F (1144K), 1 Hr, Air Cool; 1600F (1144K), 1011 Quench; 550F (561K), 2 + 2 Oil Quench; 550F (561K), 2 + 2	11; Double Tem 01; 1600F (114 cuble Tempered 001; 1600F (114 001; 1600F (114 1243K), 011 (1243K), 011 (1243K), 011 (1243K), 011 (153K), 011 (153K), 011 (155K), 2 + F (561K), 2 +	3 1/2 ifr, Air Cooi; Bouble Temper 2 + 3 1/2 ifr, Air Cooi; 1600F (1144K), 1 d; 110F, 1/2 Hr; Double Tempered 575F(9), 1 1/2 Hr, Air Cooi; 1600F(1144K), 1 1/2 Hr, Air Cooi; 1600F(1144K), 1 1/2 Hr, Air Cooi; 1600F(1144K), 1 1/2 Hr, Oil Quunched; Double Temper, 3 Air Cooi; 1777F (1243K), Oil Quench; Air Cooi; 1600F (1144K), : Hr, Air Cooi; 1600F (1144K),	T Herbits 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5# 2####### .:. 2	(575K) t Quench train led to 1000F, Hold Cool d; Double Temper, d, Double Temper, A Ar Cool 2 Hr 2 Hr 2 Hr 2 Hr 3 Hr (77K), 0.5 Hr Min;	. Hold 1 Hr; .mper, 2 + 2 .mper, 2 + 2 .mper, 2 + 2 .mpir, 1 + 1	Hr, 500F(533K) Hr, 675F(630K) Hr, 975F(797K)	000					
											9 94	-						

Siet el com mato):	m		,				ı						
			Compo				Typical	/Krc\ ²		dS.	Specimen		
			Heco Treat-	Test		Yield Strength	\IC \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	2.5		Thickness	Hidth	Crack	
	Form		ment	_	*F (*K)	KSI (MN/m²)	$\langle xsi / \ln \langle m m^2 \rangle$	in (mm)	Type	in (mm)	in (men)	in (mm)	Ref.
Plate: 0	0.095 in (2.4 mm) Thick	m) Thick	Α,1	J-T	75(297)		(05)95	0.095(2.4)	ខ	0,095' 2.4) 1.75 (44.4) 0.7	1.75 (44.4)	0.7 (17.8)	1,2
				L-1	-100(200)	253(1745)	37(41)	0.053(1.3)	ខ	0.095(2.4) 1.75 (44.4) 0.7	1,75 (44.4)	0.7 (17.8)	
				L-1	-200(144)	263(1415)	36(40)	0.047(1.2)	ខ	0.095(2.4) 1	1.75 (44.4) 0.7	0.7 (17.8)	
Plate: 0	0.5 in (12.7 mm) Thick) Thick	B,2	r-s	70(294)	203(1400)	110(120)	0.734(18.6)	Bend	0.75 (19.1) 1.5 (38.1) 0.368(9.3)	1,5 (38.1)	0.368(9.3)	20
				r-s	70(294)	231 (1523)	(99) 119	0.174(4.4)	Bend	0.257(6.5) 0.486(12.3) 0.245(6.2)),486(12.3)	0.245(6.2)	
Plate: '0	'0.75 in (19.1 mm) Thick	m) Thick	8,1	:	70(294)	247 (1703)	67 (74)	0.735(18.7)	Bend	0.75 (19.1) 9.75 (19.1)).75 (19.1)	i	46
Plate:	0.8 in (20.3 mm)	_	۲,3	:	175 (353)	211(1455)	92(101)	0.475 (12.1)	ដ	0.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	5.1
	5			!	70(294)	217 (1496)	94 (103)	0.469 (11.9)	៦	0.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	
				;	-20(244)	226(1558)	72(79)	0.254 (6.4)	5	9.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	
Plate: 1	1.5-1.8 in	-		;	175 (353)	211(1455)	92(101)	0.475 (12.1)	ಕ	3.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	
	Thick			:	70(294)	217 (1496)	79(87)	0.331 (8.4)	cr	0.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	
				;	-20(244)	226(1558)	50(55)	0.122 (3.1)	ե	0.75 (19.1) 1.5	1.5 (38.1)	0.75 (19.1)	~
				;	-65(219)	228(1572)	46(51)	0.102 (2.6)	ដ	0.75 (19.1) 1.5	1.5 (38.1)	0,75 (19,1)	
Forging:	0.8 in (29.3			;	70(294)	214(1476)	97(107)	0.514 (13.0)	ರ	0.75 (19.1) 1.5	1,5 (38,1)	0.75 (1° 1	
	1.5-1.8 in			1	70(294)	214 (1476)	(66)06	0.442 (11.2)	ដ	0.75 (19.1) 1.5	1.5 (38.1)	6,75 (19.1)	
	mm) Thick				-65(219)	225(1551)	45 (50)	0.100(2.5)	5	0.75 (19.1) 1.5	(38.1)	0.75 (19.1)	
Billet:	3 in (72.6 mm)		D,4	3	70(294)	208(1454)	105(115)	0.637 (16.2)	ե	0.75 (19.1) 1.5	(38.1)	0.75 (19.1)	62
	;		0,5	81	70(294)	215(1482)	84(92)	0.382 (9.7)	5	0.75 (19.1) i.5		(38.1) 0.75 (19.1)	
COMPOSITION	ION												
	되	اح	S S 1	N T	의	기							
< ₽	0.47 9.85 0.45 ¢.69	0.007 0.008	0.005 0.20	0.20 0.57 0.056 0.055	1.07 1.01 1.01 1.08	0.08 0.06 0.08 0.07							
ນດ	0.475N 0.75N 0.47 0.90	0,015M 0.010	0.015M 0.2 0.007 0.3	0.22M 0.55N 0.30 0.55	-0		17<	v					

(Sheet 2 of 2) STEEL, LOW Alloy: D6AC

Table 7 (Cont.)

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	-odmoo				Typical	/K1C/2		S	pecimen		
	Heat Treet	Test	Temp	Yield Strength	, , , , , , , , , , , , , , , , , , ,	2.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3		Thicknass	Width	Crack Length	
Form	Ment	tion	*F (*K)	KSI (MN/m²)	KSIVIn (MN m 2)	in (ma)	Type	in (ma)	‡n (mm)	fr. (74 0)	Ref.

HEAT TREATMENT

ų;

1650F (1172K); 1550F (1117K), 0il Quenched 150F (339K); Temper 1 Hr + 1 Hr, 500F (533K)
1550F (1117K) in Salt, 20 min, 0il Quench, Temper 1 Hr + 1 Hr, 500F (533K)
1700F (1.00K); Quench in Furnace to 975 + 25F (797 + 14K) at 6F (3.3K) per minute
from 1350 to 1150F (1006 to 894K), 0i, Quench 140F (334K); Temper 1000-1025F
(811-823K), 1 Hr + 1 Hr
1765F (1203K), Air Cool; 1615F (1153K), 0il Quench at 363F (457K), 1 Hr; Temper 841F (723K), 2 Hr
1705 (1203K), Air Cool; 1615 F (1153K), 0il Quench at 363F (457K), 1 Hr; Temper 1021F
(823K), 2 Hr

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SHEL, Low Alloy: EN24, Ni-Cr-Mo-V	No-V			lable	8 0					
	Compo- sition,			1			S	Specimen		
Forz	Treat	Test Orienta- tion	Temp °F (2K)	Strength KSI (MN/m ²)	$\begin{pmatrix} 1 & 1 \\ KST_{1}/f_{11} & MN_{11} - \frac{3}{2} \end{pmatrix}$	2.5 (a/ys)	Thickness	Watch	Crack Length	9
EN24 Ingot: S in (127 mm) Sq.	Α, 1	L-ST	70(294)	231(1590)	64(70)	0.192 (4.9)		0.)84 (25)	· .	- E
	A, 2		70(294)	220(1520)	37 (41)	0.071 (1.8)	Bend 0.482 (12.5)	0.984 (25)		;
	A, 3		70 (294)	206(1420)	75(83)	0.331 (8.4)	Bend 0.482 (12.5)			
	۸,4		70(294)	206(1420)	41 (45)	0.099 (2.5)	Bend 0.482 (12.5)	0.984 (25)		
Vi-Cr-40-V	7.5		70(294)	186(1285)	71 (78)	0.364 (9.3)	Bend 0.482 (12.5)	0.984 (25)		
Bar 1.0 x 3.312 in (25.4 x 7.9 mm)	3°.	-	(1957)04	263(1837)	45(48)	0.074(1.9)	Bend 0.187(4.7)	0.75(19.1)	;	47
	.	-	98(29.0)	25; (1753)	49(53)	0.096(2.4)				
	# . #	·	16(294)	241 (1683)	(95) 15	0.112(2.8)				
	a.	<u>.</u>	(167)04)	247 (1725)	67 (73)	0.185(4.7)				
	٠, او	-	10(294)	236(1648)	63(69)	0.180(4.6)				
COMPOSITION										
C III Si	٠ -	7	, r	Si Cu	V IA					
A 0.39 0.57 0.28 B 0.45 0.44 0.79 C 0.39 1.15 1.45	0.021 0.038 0.012 0.008 0.008 0.006	52.1	1.10 0.24 1.51 0.88 0.09 0.30	23 0.16	020					
HLAI TAEATMENT					1					
(1113K), les: 661F (1128), (1128), (1123K), (1123K),	(623K), 4 Hr (623K), 4 Hr A Hr, 5:11 Quench; 181F (523K), 1 Hr Hold I min, 0:11 Quench; 6:9F (623K), 1 Hr 1 Hr, 0:11 Quench; 6:9F (623K), 1 Hr 1 Hr, 0:13 Quench; 6:9F (623K), 1 Hr	erch, 7 cycle (\$23K) str. (\$23K) str. (\$23K) str. (\$23K) str. (\$23K)	101d 40 Sec, Oll Quench, 7 cycles; 1596F (1133K), H (623K), 4 Hr A Hr. 511 Quench; 181F (523K), 1 Hr Hold L nin, Oll Quench, 1 cycles; 661F (623K), 4 Hr 1 Hr, Oll Quench; 661F (623K), 1 Hr 1 Hr, Oll Quench; 661F (623K), 1 Hr	Hold 40 Sec, Oil Quench, 7 cycles; 1896f (1133K), Hold 1 min, Oil Quench, (623K), 4 Hr. A Hr. 5il Quench; 181f (523K), 1 Hr. Hold I min, Oil Quench, 4 cycles; 661f (623K), 4 Hr. I Hr, Oil Quench; 661f (623K), 1 Hr. I Hr, Oil Quench; 661f (723K), 1 Hr.	in, 911 Quench,					
16904 (1193K), 1690F (1193K), 1690F (1193K), 1561F (1123K),	011 Quench; refrigerated at - 011 Quench; refrigerated at - 911 Quench; refrigerated 1t 011 Quenched; femper 706F (64) 011 Quenched; Temper 481F (52)	ated at -9 ated at -9 ated at -9 706F (648		(203K); Tempered 481F (S23K) (203K); Tempered 571F (573K) (203K); Tempered 661F (623K)	8888 4					

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Form Form (100)						
Form Acres (100) % Asi (41/m²)	Typical Kr	/KIC \	Sp	Specimen		Γ
Constitution of the consti	-3 N/a 2	2. J(ys) in (rm.) Type	Thickness	Width.	Crack Length	38
Plate: 1.5 in (38.1 nm) Thick A,1 1-1, -100 (200) 98 (1365)	1	1 _	(35.5)	1 _	1.4 (35.5)	4
-321 (78) 240 (1655)	49 (54) 0.10	0.10 (2.6) Bend 1.	Bend 1 '35.')	2.8 (7.1)	1,4 (35,5)	
Plater 2.5 in (63.5 an) Thick A,2 i-1 73 (246) 150 (1310)	142 (156) 1.53	1.53 (38.9) CT 2.	2.0 (50.8)	6.0 (152)	2.9 (73.7)	23.0
Plute: 4 in (101.6 mm) Thick B,2 S-1, 85 (302 186 (1285)	122 (136) 0.98	0.98 (24.9) Cf 1.	1.0 (25.4)	_	1.5 (38.1)	
COMPUSIFICE						
10 15 2 4 10 10 10 10 15 5 5 Cu						
A 0.21 8.90 4.24 0.0 0.02 0.74 0.07 0.000 0.007 0.01 - B 0.19 5.40 1.52 0.29 0.90 0.85 0.17 0.008 0.005 0.08 0.17						
HEAT FREATHLYT						
1. Normalize 1650f (2172k), 1.5 lif, Air (o. 1, Sustenitize 1800f (1089k), 1.5 lif Mater Quench; Jenner 1025f (823k), 6 lif	ter Quench;					
2. 1525f (101k), Oil Quench; -100f (200k), , ur; 1025f (825k), 6 ftr						
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STEEL, Nickol:	ckol: 9Ni-4Co3C	-			Table 10	-	1		-		-		
-		Compo-		-	-	Typical		/kr.\2		Ş	Specimen		,
-	Form	Heat Treat-	Test Orienta-	Temp OR (Og).	Yield Sevength KSI (MV/m²)	CEST (TE (MN)	<u>3</u> 3	2.5 (gys)	1)ype	Thickness in (mm)	Midth in (000)	Crack Length in (mm)	Ref
Plate:	3. In (76.2 tm) Thick	Α,1	T-1	82 (300)	215 (1482)	88 (50)		0.44 (11.2)	5	CT 1.0 (25.4)	3.0 (76.2) 1.5(36.1)	1.5(36'.1)	<u> </u>
Forging:	4.5 x 4.5 in (114.3 x 114.3 x mm)	B,2	L-1	70(294)	223 (1535)	99(110)		0.49 (12.5)) DEC	DEC (50(12.7)	3.0 (76.1) 0.5(12.7)	0.5(12.7)	91
			.,	-100(200)	202(1792)	(69)59		0.25 (6.4)	0 230	DEC 0,50(12.7)	3.0 (76.1) 0.5(12.7)	0.5(12.7)	
Forzing:	3 in (76.2 mm) Thick	د,3	T-L	150(339)	(175(1368)	108(121)	_	0.95 (73.2)	7 70k	90£ 2.0 (50.8)	5.1 (130) 1.8(45.7)	1.8(45.7)	=
			7.1	70(294)	177 (1220)	102(336)	T	102(356) 1.61 (41.0)	NOE 3	.0 (50.8)	WDE 2.0 (50.8) 2.25(57.3) 1.0(25.4)	1.0(25.4)	
			T-1.	70(294)	177 (1220)	100(110)		0.7,38(20.3)	,×01.2.	XOL 2.0 (50.8)	5.1 (130)	1.8(45.7)	
-			1-1	0(355)	187(1289)	105(114)	-	0.788(20.0)	WOL 2	WOL 2.0 (50.8)	5.1 (130)	1.8(45.7)	
-	-		1-1	-40(233)	188(1296)	111(121)		0.871(22,1)	NUE 2	NUL 2.¢ (50.8)	5.1 (330)	1.8(45.7)	
			7-2	-75(214)	188(1296)	112(122)		0.888(22.6)	30L 2	40L 2.0 (50.8)	5.1 (130)	1.5(45.7)	·
COMPOSITION	173k		_										<u></u>
	ម េ	2	S	윘	거 성	۰.i	ဖျ	Si					
≺ #∪	0.21 0.32 0.26	8.90 4. 7.62 4. 8.41 3.	4.24 0.20 4.25 0.16 3.9 0.33	0.92 0.94 0.48	0.74 0.07 1.03 0.08 0.40 0.07	0.009 0.005 0.008 0.	0.007 0.007 0.008	0.91 0.01 0.01					
HEAT TREATMENT	NTMENT												
•	1636 (1107K) Of 1 Octable 1008 (200K)	1000	-11-2 (3000	eli o (Atte/ 2000) eli	- i								

1525 (1103K), 011 Quench; -100F (200K), 3 Hr; 1000F (811K), 5 Hr
1125F (683F) 16 Hr, Air Cool; 1700F (1200K) 1 Hr, Air Cool; 1550F (1115K), 0.5 Hr, Sült Quench to 460F (512K); Hold 7 Hr;
Temper 1000F (811X) 2 Hr, Air Cool
1550F (117K), 2 Hr; Double Temper, 2 Hr + 2 Hr, 1000F (811K)

STEEL, NICKEL:		9N1-4Co-,4SC					Tt	Table li							ſ
		-	3	Compo-				Typical	/x.c/2		Š	Specimen			
-	Form		## E E		Test Orienta-	Temp *F (*K)	Yield Ströngth KSI (FW/m ²)	KSIVIN (MN m - 7)	$ \frac{2.5 \left(\frac{\Delta C}{\sigma_{y3}}\right)}{\ln (max)} $	1ype	Thickness in (mm)	Width in (rem)	7.1	Crack Lingth in (mm) Ro	Ref.
Piate: 0.9	95 in (2.	0.95 in (2.4 mm) Thick	k A,1		1-1	75(297)	220(1510)	\$0(55)	0.125(3.2)	ä	0.095(2.4)	1.75 (44.4) 0.	0.7 (17.8)	12
		-			7-	75(297)	224(1545)	\$0(55)	0.124(3.2)	ន	0.095(2.4) 1.75 (44.4)	1.75 (44		0.7 (17.8)	
					L-1	-100(200)	225(1540)	\$1(\$6)	0.131(3.3)	ន	0.095(2.4) 1.75 (44.4)	1.75 (44		0.7 (17.8)	
	Ξ				· :	-200(144)	226 (1575)	47(52)	0.106(2.7)	႘	0.095(2.4) 1.75 (44.4)	1.75 (44		0.7 (17.8)	
Place: 1	in (25.4 mm) Thack	m Thick	B, 2		1·L	75(297)	233(1610)	86(95)	0.34 (8.6)	Bend	0.875(22.2) 0.875(22.2)	0.875(22	(2:	i	
Forging:	2 × 6 × 6	24 in (228.6	6 x C,3	m	L-1	70(294)	198(1365)	109(120)	0.755(19.2)	ន	1.0 (25.4)	9.0 (228.6)		2.6 (60) 5	So
•	228.6 X 6	19.6 MB)				-110(194)	211 (1453)	\$5(60)	0.172(4.3)	ខ	1.0 (25.4)	9.0 (228.6)		2.6 (60)	
Forging:	3 x 9 x 2,	3 x 9 x 24 in (76.2	x 0,4		1:	70(294)	225(1550)	(86)06	0.4 (10.2)	Bend	0.480(12.2)	1.5	(38.1) 0,	0.31(7.9)	
•	228.6 x 6.	19.6 mm)			1-1	-65(219)	;	(8(75)	:	Bend	0.480(12.2)	1.5	(38.1) 0	0.33(8.4)	
Forging:	3 x 9 x 24 in	4 in (76.2	2 × E,5		1-t	300(422)	195 (1344)	83(90)	0.453(11.5)	Bend	0.480(12.2)	1.5	(38.1) 0	0.36(9.1) 1	13
•	228.6 x 6	09.6 mm)			1-1	75(287)	225(1550)	89(97)	0.392(10.0)	Bend	0.480(12.2)	1.5 (38.1) 0	0.31(17.9)	
					L-1	-65 (216)	240(1655)	89(97)	0.344(8.7)	Bend	0,480(12.2) 1.5		(38.1) 6	6.32(8.1)	
					T-L	-65(219)	!	68(75)	:	Bend.	0.480(''.2)	1.5	38.1) 0	0.33(8.4)	··
					S-L	-64(219)	;	79(87)	:	Ben J	0.480(12.2)	1.5	(38.1) 0	0.36(9.1)	
					T-1.	110(194)	243(1675)	62(68)	0.163(4.1)	Bond 4 pt	0.480(12.2)	1.5	(38.1) 0.	0.35(8.9)	
COMPOSITION	2 2.							HEAT TREATMENT	ENT						
	υl	N	되	₹ļ	히	>1	P S Si	1. 1450F	(1060K), 011 Qu	ench; 7	Oil Quench; Temper 1 Hr + 1 Hr, 6007	1 Hr, 6007	7 (589K)	<u>Ω</u>	*******
~ ≪ 60 s	0.45				0.30		600.0	; ₁₆	450F (55K), 6 Hr, Air Cool 1600F (1144K), 1 Hr, Air Cool; 1450F (1061K), 30 min;	r Cool	1; 1450F (10	61K), 30 m	ıin;	.	
n a c	0.45	7.90 4.	3.81 0.13 4.26 0.09 4.03 0.19	0.22		0.10	0.003 0.003 0.01 0.003 0.011 0.05 0.010 0.009 0.02	4	Sair Quench, 450F (505K), 6 kF, Air Coci; Double Temper 1 Hr + 1 Hr, 700F (644K) 1500F (1089K), 1 Hr, Sair Quench 475F (519K) 6 Hr	Salt Ou	oof (644K) ench 47SF (5	19K) 6 Hr			
				-			22×		1550 - 1650F (1117-11) 30 min; 1500F (1089K) 6 Hr, Air Cool	72K) 1 1 Ifr:	Hr, Alt Cool 465F (S14K)	; iisur (8 Salt (8ath,	943.)		
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STEEL: 10 Nichel				Table 12	2						
	Compo- sition,			7,517	Typical	/K _{IC} / ²		ds.	Specimen		Γ
Form	Treat-	- Orients- tion	Temp *F (*K)	Strength KSI (MN/m ²)	$\left(\frac{3}{\text{KSI}\sqrt{\text{in}}}\left(\frac{3}{\text{MN m}^2}\right)\right)$	in (mex) Type	7ype	Thickness in (mm)	Width in (mm)	Crack Length in (mm)	Ref.
Plate: 0.5 in (12.7 mm) Thick	1,7	L-7	70(294)	257(1772)	51 (56)	0.98 (2.5) Bend 0.5(12.7) 1.0 (25.4)	Bend	0.5(12.7)	1.0 (25.4)	, –	8
		T-L	70(294)	256(1765)	52(57)	0.103 (2.6)	Bend	0.5 (12.7)	0.103 (2.6) Bend 0.5 (12.7) 1.0 (25.4) 0.5 (12.7)	0.5 (12.7)	
	8,2	J-L	70(294)	256(1765)	87 (96)	0.352 (8.9)	Bend	0.5 (12.7)	1.0 (25.4)	0.5 (12.7)	
	C,2	1-L	70(294)	272(1875)	73(80)	0.216 (5.5)	Bend	0.5 (12.7)	1.0 (25.4)	0.5 (12.7)	
	0,5	1-1	70(294)	257 (1772)	77(85)	0.618 (15.7) Bend 0.5 (12.7) 1.0 (25.4)	Bend	0.5(12.7)	1.0 (25.4)		· •
											

COMPOSITION

ვ	
01	3 0.01 3 0.001 5 0.001
zi	0.002
₩	9.008 9.002 0.004
윘	0.98 0.98 1.01 0.79
Ӹ	2.00 1.94 1.99
Ħ	10.08 9.68 10.10
ន	0.12 0.13 0.11 0.12
ωi	0.003 0.003 0.003
۵i	0.001 0.001 0.002
£	0.15 0.13 0.14 0.11
ပ၊	0.26 0.23 0.25 0.25
	< # 0 0

HEAT TRAINENT

- 1650F (1172K), 1 Hr. Kater Quenched; 1500F (1089K), 1 Hr., Kater Quench; Temper 956F (783K), 1 Hr. Keier Quench;
 1 Heat to 1950F (839K), Hold, Hoat to 1550F (1117K), Hold, Keiter Quench, Repeat Cycle 4 Times, Temper 950F (783K), 5 Hr
 - Heat to 1120F (879K), Hold 6 Suc, Heat to 1450F (1060K), Hold 8 Sec, Fater Quench, Augeat Cycle 4 Times, Tempor 400F (478K), 5 Hr ۲,

7
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Ü

		Ref.	23		85		·		_		····			
			1.6 (40.7)	1.6 (40.7)	1.6 (40.7) 85									
		Crack Langth in (mm)	1.6	1.6	1.6									
	Specimen	Width in (mm)	(25.4) 4.5 (114.3)	(25.4) 4.5 (114.3)	(50.8) 5.95(151)	2 (50.8)								
	S	Thickness in (mm)	1 (25.4)	1 (25.4)	2 (50.8)	2 (50.8) 2								
		1yp•	SEN	SEN	Bend	& pt Bend								
	$/\kappa_{\rm rc}/^2$	2.5 (0.86 (21.8) SEN	1.175 (29.9) SEN	1.28 (32.5)	4 pt 1.56 (39.6) Bend								
	1	$\left(\frac{1}{KSI\sqrt{In}} \left(\frac{3}{MN} \right) \right)$	100(110)	120(132)	125(138)	147 (162)			اسه	0.16 0.16	0.47			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
e 13				_	_	_			<u>-</u>		0.24			
Table 13		Yield Strength KSI (MN/m ²)	171 (1179)	185(1276)	175(1207)	186(1282)			Mo 11		2.86 0. 3.18 0.			
									회		5.21 2			
		Temp F (°K)	70(294)	70(294)	20(294)	70(294)	•		ž		12.1		3 Hr 30 Hr	
		Test Orienta-	L-T	1-L	L-1				SI SI	0.07	0.094		(756K), 3 (756K), 30	
	2.5			م ــــ		۵.			νI	0.005	0.008		900F (7 900F (7	
	Compo	Heat Treat-	A,1	B, 1	С,1	D,2			اله	0.007	0.004		Temper Femper	
			4 mm)		8 mm)				ž	80.0	0.088		(1089K); Temper 900F (1089K); Temper 900F	
12 Nickel		_	1 in (25.4 mm)	, mick	2 in (50.8 mm)	I MICK		ION	ပ၊	0.033	0.23	VTKENT	1500F (10	
Maraging 12 Nickel		Form	Plate:		Plate:			COMPOSITION		∢ £0	۵۵	HEAT TREATMENT	7.	
STEEL: M														

1.10 (25.4 mm)		Compo	-0 -			Typical	/Krc\ ²			Specimen		
	Form	Hea Trea		Temp F (*K)	Yield Strøngth KSI (MV/m ²)	$\left \frac{^{h_{1C}}}{^{KSI\sqrt{in}} \left(\frac{3}{^{MN}} \right)^{-\frac{3}{2}}} \right $		1yp•	Thickness in (mm)	Midth in (mm)	Crack Length in (mm)	Ref.
1.00 1.00	Plate: 1 in (25.4 mm) Thick	A, I	L-T	-321(18)	241 (1662)	115(127)	0.569 (14.5)			4) 3.0 (76.2)		9
Coorsign	Plate: 2 in (50.8 mm) Thick	, 1,	1-3	75(297)	187 (1289)	152(167)			2.0 (50.			8 6
T-S T0(294) 194(1334) 100(110) 0.6 T-S T0(294) 194(1334) 78(86) 0.4 T-S T0(294) 194(1334) 78(86) 0.4 T-L T0(294) 194(1334) 78(86) 0.4 S-L T-L T0(294) 198(1365) 70(75) 0.3 S-L T-L T0(294) 198(1365) 70(75) 0.3 S-L T-L T0(290) 229(1580) 164(179) 1.7 T-L -321(78) 229(1580) 164(179) 1.2 T-L -321(78) 229(1580) 164(179) 1.2 T-L -321(78) 234(1613) 79(87) 0.3 S-L T-L T5(297) 190(1310) 1.2 S-L T-L T6(145) 1.2 S-L T6(1720) 1.2	late: 2 in (50.8 mm)	D,3	S-7	70(294)	197(1356)	104(114)	0.697 (17.7)		:	•	:	17
T-S T0(294) 194(1334) 78(86) 0.4 T-L T0(294) 195(1347) 75(83) 0.3 S-L T0(294) 195(1347) 70(75) 0.3 S-L T0(294) 196(1365) 70(75) 0.3 S-L T0(294) 196(1365) 70(75) 0.3 S-L T-L T5(297) 206(1420) 170(187) 1.7 T-L -321(78) 229(1580) 164(179) 1.2 T-L -321(78) 229(1580) 164(179) 1.2 S-L T-L T5(297) 271(1870) 292(101) 0.3 S-L T-L T5(297) 271(1870) 292(101) 0.3 S-L T-L T5(297) 271(1455) 103(113) 0.3 S-L T-L T5(297) 174(1200) 129(142) 1.1 S-L T-L T5(297) 174(1200) 179(142) 1.1 S-L T-L T5(297) 176(1145) 176(1145) 1.1 S-L T-L T5(297) 176(1145) 176(1145) 1.1 S-L T-L T650F (1172X) 1.1 S-L T650F (1172X) 1.1 S	Inick		L-1	70(294)	192(1324)	100(110)			:	:	:	
T-L T0(294) 195(1365) 70(75) 0.3 S-L T0(294) 198(1365) 70(75) 0.3 S-L T-L T5(297) 206(1420) 170(187) 1.7 T-L -100(200) 229(1580) 164(179) 1.2 T-L -321(78) 271(1870) 79(87) 0.3 T-L -321(78) 271(1870) 79(87) 0.3 T-L -321(78) 271(1870) 79(87) 0.3 S in (108 mm) C,5 L-T T5(297) 271(1870) 103(113) 0.3 S in (108 mm) C,7 L-T T5(297) 171(1455) 103(113) 0.3 S in (108 mm) C,7 L-T T5(297) 171(1455) 172(142) 1.1 C,7 L-T T5(297) 174(1200) 180(198) 2.6 C,8 L-T T5(297) 174(1200) 180(198) 2.6 C,9 M,			T-S	70(294)	194(1334)	78(86)	0.404 (10.3)		:	: :	:	
S-L 70(294) 198(1365) 70(75) 0.3			T-t	70(294)	195(1347)	75(83)	0.370 (9.4)	(a)	;	;	;	
S in (54mm) B, 4 T-L			3-L	70(294)	198(1365)	70(75)		(e)	i	ŧ \$ \$	*	
T-L -321(78) 271(1870) 79(87) 0.2 T-L -321(78) 271(1870) 79(87) 0.2 T-L -321(78) 271(1870) 79(87) 0.2 s in (108 mm)		3,4	1-L	75 (297)	206(1420)	170(187)			2.0 (50.0		2.0(50.8)	4
Fin (108 mm) C, S L-T 75(297) 234(1613) 92(101) 0.35(297) 211(1455) 211(1455) 210(113) 0.35(297) 211(1455) 103(113) 0.35(297) 103(113) 0.35(297) 103(113) 0.35(297) 103(113) 0.35(297) 104(1145) 103(113) 0.35(297) 104(1145) 103(113) 0.35(297) 104(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1145) 105(1188	Inter		7-1	-100(200)	229(1580)	164 (179)					2.0(50.8)	
ck Con.E1. Vac clift (108 mm)			7-	-321(78)	271 (1870)	79(87)		Bend			2.0(50.8)	
Et. Montell vac 2300F (1553K) C,7 L-T 75(297) 190(1310) 129(142) 1.1 C,8 L-T 75(297) 174(1200) 180(198) 2.6 C,7 L-T 75(297) 174(1200) 180(198) 2.6 C,9 L-T 75(297) 166(1145) 180(198) 2.1500F (1089K), 2.1500F (1089K), 3.1 Aged 895F (172K), 0.003 0.007 0.003 0.007 0.003 17.90 7.75 0.29 0.20 0.007 0.008 0.008 0.007 0.008 0.008 0.008 17.78 7.50 0.008 0.008 0.008 0.008 17.78 7.50 0.008 0.008 0.008 0.008 0.008 17.78 7.50 0.008 0		6,5	L-7	75 (297)	234(1613)	92(101)	0.386 (9.8)	Bend	3.94 (100		4.0 (102)	78
C,R L-T 75(297) 190(1310) 129(142) 1.1 C,B L-T 75(297) 174(1200) 180(198) 2.6 C,C,C L-T 75(297) 166(1145) 187(206) 3.1 HEAT TREATMENT C,C,C L-T 75(297) 166(1145) 187(206) 3.1 HEAT TREATMENT C,C,C L-T 75(297) 166(1145) 187(206) 3.1 C,C,C L-T 75(297) 166(1145) 187(206) 3.1 HEAT TREATMENT C,C,C L-T 75(297) 166(1145) 18.606 (1088K), 3.1 C,C,C L-T 75(297) 166(1145) 18.606 (1088K), 3.1 C,C,C L-T 75(297) 166(1145) 18.606 (1088K), 3.1 C,C,C L-T 75(297) 166(1145) 166(1168K), 3.1 C,C,C L-T 75(297) 166(1145) 1650F (1172K), 3.1 C,C,C MM E S SI MI CO MOS 17.90 1.28 1.28 1.28 1.28 1.28 1.28 1.28 1.28	Remelt, Not Rolled	9,0	1-1	75(297)	211 (1455)	103(113)	0.596 (15.1)		3.94 (100		3.22 (81.8)	
C,8	at 2500F (1555K)	C,7	L-1	75(297)	190(1310)	129(142)	1.152 (2.93)		3.94 (100		3.92 (99.6)	
C,7 L-T 75(297) 166(1145) 187(206) 3.1 HEAT TREATMENT en in accordance with ASTM Recommendations C Min E S Si Ni Co Mo T.75 2.96 0.20 - 6 1650F (1172K), 0.003 0.02 0.003 0.008 0.02 18.40 8.50 3.34 0.20 0.07 0.10 7. 1650F (1172K), 0.02 0.07 0.001 0.009 0.08 17.78 7.97 4.46 0.185 - 8 1650F (1172K), 0.03 0.02 0.07 0.010 0.010 0.011 0.12M 18N 7.5N 3.25N 0.28N 0.1N 0.5M 9. 1650F (1172K),		8,2	T-1	75 (297)	174(1200)	180(198)	2.675 (68.0)		3.93 (100		3.98 (101)	
en in accordance with ASTM Recommendations 1. 1500F (1089K), 2. 1500F (1089K), 3. Aged 895F (753) 2. 1500F (1089K), 3. Aged 805F (753) 3. Aged 895F (753) 4. 1650F (1172K), 6.003 0.007 0.005 17.90 7.75 2.96 0.20 - 6. 1650F (1172K), 6.005 0.03 0.005 0.008 0.02 18.40 8.50 3.34 0.20 0.07 0.10 7. 1650F (1172K), 6.02 0.07 0.001 0.009 0.08 17.78 7.07 4.46 0.185 - 8. 1650F (1172K), 6.03K 0.12H 0.01H 0.01H 0.12H 18N 7.5N 3.25N 0.28N 0.1N 0.5H 9. 1650F (1172K),		c,2	r-7	75(297)	166(1145)	187 (206)	3.173 (80.6)		3.93 (100		3.20 (81.3)	
C Mn E S SI NI CO MO TI AI Cr 5. 1650F (1172K), 4.5 Hr, AIr Cool; 850F (728K), 100 Hr 0.003 0.007 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.008 0.02 18.40 8.50 3.34 0.20 0.07 0.10 7. 1650F (1172K), 4.5 Hr, AIr Cool; 1000F (811K), 6 Hr 0.005 0.00 0.008 0.02 18.40 8.50 3.34 0.20 0.07 0.10 7. 1650F (1172K), 4.5 Hr, AIr Cool; 1050F (838K), 6 Hr 0.02 0.00 0.009 0.08 17.78 7 07 4.46 0.185 - 8. 1650F (1172K), 4.5 Hr, AIr Cool; 1100F (867K), 6 Hr 0.03M 0.01M 0.01M 0.01M 18N 7.5N 3.25N 0.28N 0.1N 0.5M 0.15K), 4.5 Hr, AIr Cool; 1100F (867K), 24 Hr) Specimen in accordance	with ASTM R	ocommendat i c	St.		盃	5 33 33 33	Water C F (756K r Cool;	ooled; 116), 3 Hr 1450F (10	OF (899K), 93 60K), 2 Hr, A	Min, Water (ir Cool;	Vuench
	C Mn 0.003 0.02 0.005 0.03 0.02 0.07 0.034 0.129	S 0.007 0.008 0.009	S1 N1 0.005 17.90 0.02 18.40 0.08 17.78 0.12M 18N	Co 7.75 8.50 7.57	0.20 0.20 0.185 0.185	6.6.6.6	F (756K), 2 Hr 172K), 4.5 Hr, 172K), 4.5 Hr, 172K), 4.5 Hr, 172K), 4.5 Hr, 172K), 4.5 Hr,	Air Coc Air Coc Air Coc Air Coc	11; 850F (7 11; 1000F (11; 1050F (11; 1100F	-	\$5. \$7.	

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 $(1,1)^{-1}(\theta,\phi)=(1,1)^{-1}(1,1)^{-1}$

STEEL, 18 Ni Maraging: (250 Grad	te), DTD 521	12, 6100, 1	G110, Marvel	18 (Sheet 1 of	3) Table 15	•					
SitAT, SitAT, Hat Test Temp Strength Treat Orienta Form ment tion F (7K) KSI (MM/m²)	Compo- sitir, Heat Treat- ment	Test Orienta- tion	Temp *F (*K)	Yield Strength KSI (MN/m ²)	<u>র</u>	$\left(2.5\left(\frac{\kappa_{1C}}{\sigma_{ys}}\right)^2\right)$ in (see)	Туре	Spe Thickness in (max)	Specimen Width in (mm)	Crack Length in (mm)	Ref.
250 Grade Plate: 1 in (25.4 mm) Thick	Α,λ	T-7	70(294)	259(1786)	68(74)	0.172(4.3)	Bend	0.250(6.4)	2.0 (50.8)		14
Rolled to 2 in (50.8 mm) thick- ness from Press Forged Slab	8,2	L-1	76(294)	227 (1565)	96(105)	0.447(11.3)	Bend	1.8 (45.7)	3.75(95.3)	1 1 1	15
	B,2	L-1		232(1600)	85(93)	0.336(8.5)	Bend	1.8 (45.7)	3.75(95.3)	;	
	В,3	L-1		259(1786)	ó4(92)	0.263(6.7)	Bend	1.8 (45.7)	3.75(95.3)	;	
	В,4	L-1		259(1786)	80(87)	6.239(6.1)	Bend	1.8 (45.7)	3.75(95.3)	i	
Forging: 3 in (76.2 mm) Thick	c,s	T-1	70(294)	243(1675)	99(108)	P.415(10.5)	Bend 4 pt	0.480(12.2)	1.5 (38.1)	0.3 (76)	· · · ·
		1-1	-65(219)	:	(86)06	;	Bend 4 pt	0.480(12.2)	1.5 (38.1)	0.3 (7.6)	9
Plate: 1 in (25.4 mm) Thick	9,0	•	70(294)	246(1696)	105(114)	0.455(11.6)	Bend	1.00 (25.4)	3.0 (76.2)	i	02
			0(255)	250(1724)	72(78)	0.207(5.3)	Bend	1.00 (25.4)	3.0 (76.2)	ł	
		•	-100(200)	300(2068)	75(82)	0.156(4.0)	Bend	1.00 (25.4)	3.0 (76.2)	:	
-			-200(144)	260(1834)	52(57)	0.100(2.5)	Bend	1.00 (25.4)	3.0 (76.2)	:	
		•	-385(75)	230(1586)	40(44)	0.075(1.9)	Bend	1.00 (25.4)	3.0 (76.2)	:	
Forging: 4.5 x 4.5 in (114.3 x 114.3 mm)	E, 7	L-T	-110(194)	273(1882)	86(94)	0.248(6.3)	SEN	0.250(6.4)	1.0 (25.4)	0.500(12.7)	7) 16
Vacuum Arc Remelt		T-L	-110(194)	272(1875)	80(87)	0.216(5.6)	SLN	0.250(6.4)	1.0 (25.4)	0.500(12.7)	٤
Forging: 13 x 13 in (330.2 x 330.2 mm) Vacuum Ar. Remelted	E,7	ب م	-110(194)	259(1786)	82 (89)	0.251(6.4)	SEN	0.250(6.4)	1.0(25.4)	1.500(12.7)	91 (2
		Ŧ	-194)	260(1793)	80(87)	0.237(6.0)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	<u>۔</u>
		S-T	-110(194)	262(1806)	82(89)	0.245(6.2)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	٤
		ST4-ST4	-110(194)	26.7 (1806)	72(78)	0.189(4.8)	SEN	0.250(6.4)	1.0(25.4)	0.500(32.7)	<u>۔</u>
			,		,						

Since: 10 M Maraging (250 Made), pro 3512,	Compo-	7, 0100,	0100, 0110, cuitur.		Typical			Spec	Specimen	-
Form	sition, Heat Treat-	Test Orienta-	fomp F (*K)	Yield Strength KSI (NV/m ²)	$\begin{pmatrix} \kappa_{1C} \\ \kappa_{SI\sqrt{1n}} \begin{pmatrix} -3 \\ MN \end{pmatrix} \end{pmatrix}$	$\frac{2.5 \left(\frac{71C}{\sigma_{ys}}\right)}{\text{in (mw)}}$	Туре	Thickness in (mm)	Width in (mm)	Crack Length in (mm) Ref.
Plate: 1.5 x 23 in (38.1 x 330.2 rm)		STI	-110(194)	262(1806)	83(90)	0.251(6.4)	SEA	0.250(6.4)	1,0(25.4)	0.300(12.7) 16
		1	-110(194)	267 (1841)	73(80)	0.187(4.7)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)
		st	-110(164)	267 (1841)	69(75)	0.167(4.2)	5	0.500(12.7)	1.0(25.4)	0.500(14.7)
Plate: 0.5 in (12,7 mm) Thick		1	.110(194)	264(1820)	84(92)	0,253(6.4)	SEN	0.250(6.4)	1.0(25.4)	0.560(12.7)
<u>pro 5212</u>										
Forged Flate: 2.5 in (63.5 mm) Thick (6100	æ. «	<u></u> 3	70(294	246(1696)	(100)	0.342(8.7)	(a)	;	;	
Forgod Rar: S in (127 mm)	И.11	T-3	70(294)	204(1407)	88(97)	0.465 (11.8)	(a)	:	;	69
	н, 12	T-S	20(294)	225(1551)	82(90)	0.332 (8.4)	(a)	į	;	;
	И, 13	T-S	70(294)	248(1796)	83(92)	0.280 (7.1)	(a)	;	;	:
0110										
Bar: 4.9 in (73, mm)	6,5	L-ST	70(294)	*262(*1806)	92(101)	•	(a)	;	:	70
Thick, Vac. Melted		ST-1.	70(294)	*260(*1793)	85(93)	;	(a)	÷	i	:
Bar: 8 in (203) Sq Double Vac. Solted	6,5	ST-L	70(294)	•265(1834)	82(90)	;	(e)	:	:	1 (
Plate:	ľ	i	70(254)	235(1620)	80(88)	0.290 (7.4)	Bend	0.715(18.2)	1.0(25.4)	0.47(11.9) 57
Marval 18										
	•	2-2	70(294)	245(1689)	100(110)	0.416(10.6)	Bend	0.5 (12.7)	1.0 (25.4)	09

STEEL: 18 N1 Maraging (250 Grade), DTD 5212, G100, G110, Marval 18 (Shcot 3 of 3) Table 15 (Cont.)

		Ref.						
		Crack Length in (mm)						
	Specimen	Width in (mm)						
	S	Thickness o in (mm)						
		Туре					£	
,	/K ₁ c\ ²	$\frac{2.5}{\text{in (mm)}}$		>1			6 Hrs 6 Hrs 6 Hrs 1103K) I Hr, Mater Quench; Aged 900F (750K) 5 Hr, Mater Quench 5 Hr, Air Cool 7 Air Cool 798K), 1.5 Hr 53K), 1.25 Hr 53K), 2.5 Hr	
lable is (cont.)		$\begin{pmatrix} 1C \\ M_{1}^{2} = \frac{3}{2} \end{pmatrix}$		히	0.05 - 0.05 0.25M		5 II.	
lable 1	Typical	^IC / KSI√fin (∺		7	02 0.01 - 03 0.016 - 13 0.016		10F (750)	
of 3)				ωį	0.002)6 Po 8	V
(Sheet 5 of 3)		Yield Strength KSI (MN/m ²)		디	0.32 0.40 0.50 0.42 0.42 0.5N		nch; A	28<
		Yi Stri KSI (₹	0.04 0.11 0.15 - 0.14 0.10N		ator Quor Cool	
G110, Marval 18		Temp		ဒါ	7.18 7.40 7.66 7.60 7.738 7.75N 8.0N		6 Hrs 6 Hrs 6 Hrs 124 Hrs (1103K) 1 Hr, Mator Q 3 Hr, Air Cool 758K), 3 Hr, Air Cool r, Air Cool 753K), 1.5 Hr 753K), 1.25 Hr 753K), 2.5 Hr	
6110,				S.	5.32 4.81 5.08 4.65 4.97 4.98 4.85N		(753K), 2.5 Hrs (753K), 2.4 Hrs (103 K) 1 Hrs (110 K) 1 Hr	
Ni Maraging (250 Grade), DID 5212, G100,		Test Orienta tion		핆	0.005 18.35 0.007 18.47 0.008 18.05 0.004 17.1 0.01M 18.00 0.01M 18.00 0.005M17.5N		(700K) (756K) (756K) (756K) (756K) (756K) (756K) (704 C) (704 C) (895F) (895F)	
D 5212	Compo-	Heat Treat-		Si	0.005 0.007 0.008 0.004 0.003 0.003 0.005M		3 llr Aged 800F Aged 10000 Aged 900F Aged 900F Alr Cool; Alr Cool; Alr Cool; Alr Cool; Alr Cool; Alr Cool;	
de), Di	ខេះ			۱.۵	0.006 0.005 0.002 0.003 0.003 0.005M		11, Agod 12,	
250 Gra				Si	0.09 0.01 0.003 0.03 0.05M 0.05W		; 900F (756K) ;, 94 Cool; (), Air	
guigi				돛	.020 0.05 0.006 0.06 0.030 0.10 0.030 0.002 0.020 0.05 0.01540.1M 0.01M 0.05M		089K), 089K), 089K), 089K), 112K), 112K), 112K), 099K), 093K), 091K), 091K), 091K),	
Ni Mari		Form	7	υI	0.020 0.006 0.030 0.030 0.0154 0.0184	HENI	Mill Annaal; 900F 1500F (1089K), Air 1500F (1089K), Air 1500F (1089K), Air 1500F (1089K), Air 1500F (1089K), Air 1500F (1089K), Air 1507F (1093K), Air 1471-1650F (1073-1 1471-1650F (1073-1 1471-1650F (1073-1	
SIEEL: 18			COKPOSITION		< @ U D = E U Z	REAT TREATMEN		
^ l			Ľ.	_				

Table 16

Forking: 8 in (203) Dia (Con. Elect. Vac. 1
A,1 T-L 600(589) 236(1627) 86 T-L 70(294) 280(1931) 66 T-L -100(200) 305(2103) 47 T-L -100(200) 305(2103) 47 T-L 70(294) 285(1965) 55 C,3 L-T 70(294) 280(1965) 66 T-L 70(294) 280(1931) 77 T-L 70(294) 280(1931) 77 T-L 70(294) 280(1931) 77 E,4 L-T 70(294) 280(1931) 77 S1 P S NI Mo (Co NI
A,1 T-L 600(589) 236(1627) T-L 70(294) 280(1931) T-L -100(200) 305(2103) B,2 L-ST 70(294) 285(1965) C,3 L-T 70(294) 285(1965) T-L 70(294) 285(1965) T-L 70(294) 280(1931) T-L 70(294) 296(2020)* Si
A,1 T-L 600(5 T-L 70(29 T-
A,11 A,11 B,2 C,3 C,3 D,5 B,0 0.07 0.07 0.06 0.01
E,4
Plate Forgi

0.03 0.05 0.03 0.05 0.03 0.021 0.014 0.05 0.014 0.05

HEAF TREATMENT

¹⁶⁵⁰F (1172K), 1 Hr, Air Cool; Age 850F (728K), 3 Hr
1500F (1089K), Age 900F (756K), 3 Hr
bouble Anneal, 1700F (1200K), 1 Hr, Fan Cool to 200F (367K), 1500F (1089K), 1 Hr, Fan Cool to 200F (367K), Aged 900F (756K), 6 Hr
1507F (1093K), Air Cool; 895F (753K), 3 Hr, Air Cool

		Comp	9 6				-	Typical	/K _{TC} /2			Specimen			
Form		Heat Treat- ment	t Test it Orienta- it tion	t n *F	Temp F (°K)	Yield Strength K_I (MN/m ²)		$KSI\sqrt{in}\left(\frac{1}{NN} \frac{3}{m^{2}}\right)$	$\begin{cases} 2.5 \left(\frac{1}{\sigma_{y,q}} \right) \\ \text{in (mm)} \end{cases}$	Туре	Thickness in (mm)	Wideh in (520)		Crack Length In (SK)	Ref.
Biller:	4 in (102mm)	Α,1	S-T		70(294)	338 (2330)	-	37 (40	0.030 (0.8)	Bend 0	.394(10)	0.030 (0.8) Bend 0.394(10) 0.394 (10)	0.15	0.15 (3.8)	17
· -	eq. cons. rice.		S-1.		70(294)) •		37 (40)		Bend 0	Bend 0.394(10)	0.394 (10)		0.15 (3.6)	
			r-s		70(294)	334(2302)	•	36(39)	0.029 (0.7) Bend 0.394(10)	Bend 0	.394(10)	0.394 (10)		0.15 (3.8)	
COMPOSITION	š														
	밁	Si	SI SI	귉	위	S	리	B 2r							
K	0.003 0.01	0.010	0.010 0.902 0.905	18.61	4.64	11.93 6.13	1.36	0.001 0.01							

Table 17

SHIL, 18Ni: Maraging: 35g Grade

1. Double Anneal, 1700F (1200K), 1 Hr; 1500F (1089K), 1 Hr; Aged 900F (750K), 8 Hr

HEAT FREATMENT

STAINLESS STEEL: 17-4 PH

Table 18

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HEAT TREADMENT

¹⁴⁰⁰F, (1033K) 1 1/2 Hr; Cool to 55F (286K), Age 900F (756k), 1 Hr H975 Condition 9x0F (756K), 1 Hr, (H900 Condition) ~; ~; ~;

			Compo-			-		Typical	/K _{2.0} /2			Specimen			
		Š	sition,				Yield	K _{IC}	2.5 (15)	r		L	-	Crack	
			Heat	Test	ŧ	_	Strength	/ 3/	/s/s/		Thickness	Widt	 ::	Length	
ü		-	Trest-	Orienta-	* F (*K)	.₽	KSI (WW/m ²)	KSIVIn (MN m ²)	in (man)	Type	in (man)	in (mm)	(un	in (em)	Ref.
Plate: 0.5 in	in (12.7 mm) Thick	1	1		75(297	297)	164(1131)	66(72)	0.405(10.3)	Bend 4 nt	0.5 (12.	(12.7) 1.0 (25.4)	(25.4) (0.374(9.5)	^
			A, I	T-1	75 (:	75 (297)	153(1655)	64(70)	0.436(11.1)	Bend	0.5 (12.	(12.7) 1.0		(25.4) 0.203(1.9)	
			B,2	7	75(297)	297)	183(1262)	(69)	0.295(7.5)	Bend	0.5 (12.	(12.7) 1.0		(25.4) 0.269(6.8)	
		J	, ;; ()	I-1	75(75(297)	176(1212)	67 (74)	0.363(9.2)	Bend	0.5 (12.	(12.7) 1.0		(25.4) 0.236(6.0)	
		-7	A,1	L-T	-50(228)	228)	178(1227)	43(47)	0.146(3.7)	Bend	0.5 (12.	(12.7) 1.0		(25.4) 0.260(6.6)	
		_	c,1	L-1	-50(228)	228)	155 (1069)	51 (56)	0.271(6.9)	Bend 4	0.5 (12.	(12.7) 1.0		(25.4) 0.223(5.7)	
		_	D, 1	L-1	-50(228)	228)	179(1234)	45 (99)	0.159(4.0)	Bend	0.5 (12.	(12.7) 1.0		(25.4) 0.252(6.4)	
		•	A,1	ر- 1	-100(200)	200)	180(1241)	43(47)	0.143(3.6)	Bend	0.5 (12.	(12.7) 1.0	(25.4)	(25.4) 0.206(5.2)	
			c,1	7. T	-100(200)	200)	180(1241)	47(52)	0.170(4.3)	Bend 4 pt	0.5 (12.	(12.7) 1.0	(25.4) ((25.4) 0.211(5.4)	<u> </u>
			D,1	L-1	-100(200)	200)	190(1310)	45 (49)	0.)41(3.6)	Bend	0.5 (12.	(12.7) 1.0	(25.4)	(25.4) 0.234(5.9)	
Plate: 0.188 i	0.188 in 4.8 mm) Thick		E,2	- .7	75(75 (297)	164(1130)	56(61)	0.291(7.4)	Bend	0.223(5.7)	0.1	(25.4) ((25.4) 0.246(6.2)	
			E,2	1-1	-50(228)	228)	165 (1158)	38 (42)	0.128(3.3)	Bend Pr	0.223(5.7)	0.1.6	(25.1)	(25.1) 0.342(6.1)	
			E,2	T-1	-100(200)	(007	175(1207)	32(35)	9.084(2.1)	Pend	0.223(5.7)	0.1.0		(25.4) 0.252(6.4)	
		-	F,2	L-T	-100(200)	200)	186(1283)	47(52)	0.159(4.0)	Bend 4 pt	0.197(5.0)		0(23.1)	0.910(23.1) 0.263(6.7)	
		_	6,2	- <u>1</u>	-100(200)	200)	168(1158)	49(54)	0.212(5.4)	Bend	0.202(5.1)		0(23.6) (0.930(23.6) 0.216(5.5)	
Bar: 1 in (25.	in (25.4 mm) Thick		£,2	L-1	75(75(297)	206(1420)	(92)69	6.294(7.5)	Bend	0.610(15.	5) 0.610	6(16.6)	0.610(15.5) 0.616(16.6) 0.153(6.0)	
COMPOSITION	ان دا	Σ,	킴	퇴	اَدَ	اء	νI								
< @ t	0.080 16.9 0.080 16.9	9 7.85	1.30	0.75	0.26 0	0.011	0.013 0.013 0.008	HEAT TREATMENT							
ند <u>د</u> ر	7.3		1.05				0.007	1. 1400F (1055K) 2. 1750F (1228K)	(1055K), 1.5 Hr; Cool to 555F (564F); (1228K), 10 min; Sool to -410F (194E),	to -11	SF (S64k); 0F (194k),	Age 10 3 Hr:	50F (835) Аge 950F	(5041); Age 1050F (835k), 1.5 Hr (194k), 3 Hr; Age 950F (783K), 1 Hr	ä
: ن ت	0.069 17 2 0.077 16.7	7.29	1.08	0.03			0.013	V.							
=		l	06:0		١										

n nei seit kann press prografig II in die state der
		Ref.	7															<u> </u>	
		Crack Length in (mm)	0.300(7.6)	0.317(8.8)	0.257(6.5)	0.276(7.0)	0.238(6.0)	0.287(7.3)	0.381(9.7)	0,160(4.1)	0.269(6.8)	0.300(7.6)	0.282(7.2)	0.281(7.2)	0.3 (7.6)	0.236(6.0)		(859k), 1 lbr (853k), 1,5 lbr (5(k), 1,5 lbr	
	Specimen	Widch in (12m)	0.520(13.2) 1.0(25.1)	0.520(13.2) 1.0(25.4)	0.520(13.2) 1,0(2:.4)	0.520(13.2) 1.0(25.4)	0.510(13.0) 1.0(25.4)	0.510(13.0) 1.0(25.4)	0.510(13.0) 1.0(25.4)	0.510(13.0) 1.0(25.4)	0.510(13.0) 1.0(25.4)	0.510(13.0) 1.0(25.4)	1.0,25.4,	0.510(15.0) 1.0(25.4)	0.750(19.1) 0.750(19.1) 0.3	0.750(19.1) 0.750(19.) 0.256(6.0}		(286k); Age to 1650f (286k); Age to 1130f (286K), Age to 1080f	
	S	Thickness in (mm)	0.520(13.2	0.520(13.2	0.520(13.2	0.520(13.2)	0.510(13.0	0.510(13.0	0.510(13.0	0.510(13.0	0.510(13.0	0.510(13.0	0 7.0(13.0) 1.0.25.4	0.510(!3.0	0.750(19.1)	0.750(19.1)			
		Type	Bend 4 pf	Bend	Rend	Ber.d	Bend	Bend	Bend	Bend	Send	Bend	Bend	Bend 4	Bend 4 pt	Bend 4 pt		Cool to 5SF Cool to 5SF Cool to 5SF	
	/Krc\ ²	$ \frac{2.5}{\sigma_{ys}} \left(\frac{1c}{\sigma_{ys}} \right) $ in (mm)	0.504(12.8)	0.290(7.4)	0.118(3.0)	0.152(3.9)	0.569(14.4)	0.409(10.4)	0.170(4.3)	0.041(1.0)	0.625(15.9)	0.039(1.0)	0.17 (3.3)	0.138(3.5)	0.236(6.0)	0.197(5.0)		(1053K) 1.5 Hr; G (1053K) 1.5 Hr; G (1053K) 1.5 Hr; G	
. 20	Typical	K_{IC} $KSI\sqrt{x}n \left(\frac{3}{MN m^{-\frac{3}{2}}} \right)$	(96)88	(12)	45(49)	80(55)	76(-83)	74(81)	53(58)	28(31)	46(50)	29(32)	46(50)	47(51)	53(58)	80(55)		HYT BUATMINT: 1. 1400F (10 2. 1406F (10 3. 1400F (10	V
Table 20		4 2 <u>-</u>	<u>_</u>	5	5	6	-	2)	6	33	6	6	(0	6	દ	જ		_	**
		Yield Strength KSI (MN/m ²)	196(1351)	191 (1317)	297 (1427)	205(1400)	195(1344)	183(1262)	203(1400)	218(1503)	(0521) F81	232(11:30)	203(1400)	200(1379)	173(1193)	178 (1228)		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
	_	x				•												0.012 0.012 0.018 0.018	
		Temp (*K)	+200(367)	.200(367)	70(294)	70(294)	70(294)	70(294)	-50(228)	-50(228)	-50(228)	-160(200)	-100(200)	-100(200)	5(297)	75(297)		0.00 0.26 0.38	
	Сощоо-	<u></u>	1	Ť		-	•		Ÿ	77	Ÿ	7	7	7	•	••		\frac{\lambda}{0.61} 0.61 0.52 0.75	
PH 15-7 No		Test Orient	1:1	1-1	T-1	ا .	L-1	1-1	<u>:</u>	7	ŗ.	٦.	<u>;</u>	J F	r-1	1-1		A1 1.28 1.19 1.15	
		sition, Heat Treat- ment	A,1	В,1	۸,1	B,1	4,2	A,2	A,2	A, 1	B,2	В,1		5,4	۲,3	8,3		2.30 2.37 2.37 2.16 2.21	
			ا ځ															N. 7.71 7.31 7.33 7.43	
			m) Thick												Thick			15.3 15.1 14.6	
		Form	in (12.7 mm)															C 0.070 0.055 0.060	
SIAINLESS STEEL:		3	Plate: 0.5 in												r: 1 in (25.4 rm)		COMPOS: TICN:	4 & U &	
SIA	L		<u>ا</u> ھُ												Bar:		<u> </u>		

SIMINIES STILL: PHIS-8 NO and IV 5208	V 520B			CET	Table 21						1
	-odwo2				Typica1	/Krc\ ²		Spe	Specimen		
	sition, Heat Treat-		Temp	Yield Strength	$\begin{pmatrix} \kappa_{1C} \\ \kappa_{2C} \\ \kappa_{2C} \end{pmatrix} = \frac{3}{2}$	$\left(\frac{2.5}{\sigma_{ys}}\right)$	Type	Thickness in (mm)	Width in (mm)	Length in (mm)	Ref.
form	ment	tion	(X)	KSI (MN/m)	איזון (ניוני יוון /	7	- 1				
Full3-639) Forving: 4.5 x 4.5 in (114.3 x 111.5 mm)	۸,۱	L-1	70(204)	206(1120)	92(100)	0.500(12.7)	DI.C	0.500(12.7) 3 0(76.2)	3 0(76.2)	0.500(12.7)	91
		L-T	-110(191)	229(1579)	43(47,	0.088(2.2)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	
		1-L	-:10(194)	227 (1565)	41(45)	0.081(2.1)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	
forging: 13 x 13 in		11	.110(194)	224 (1544)	53(58)	0.146(3.7)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	
		1-1.	-110(194)	218 (1503)	57 (62)	0.171(4.3)	SEN	0.250(6.4)	1,0(25,4)	0.500(12.7)	
Plate: 1.5 v 13 in		:	-110(194)	219(1510)	47(51)	0.115(2.9)	SEN	0.250(6.4)	1.0(25.1)	0.500(12.7)	
(38.1 x 330.2 nm)		J. L	-110(194)	226(1558)	47(51)	0.108(2.7)	SEN	0.250(6.4)	1.0(25.4)	0.500(12.7)	
lorging 9 x 9 in	8,2	1-18	70(294)	205(1412)	86(68)	0.468(11.9)	ខ	1.0(25.4)	8.6(21.8)	:	20
(229 x 229 mr)		L-1S	-110(194)	(0151)617	42(46)	0.092(2.3)	ខ	1.0(25.4)	8.6(21.8)	;	
1V5.20H											
Bar. 6 in (152 mm) Dia	C,2	7-7 7-	70(294)	170(1172)	119(131)	1.225 (31.1) (a)	(E)	:	: : :	;	9
(a) specimen in .c ordance with ASET Recommendation	ch ASET Rec	ormendat ic	nı s								
COMPOSITION											
w 15 5	اري د ا	읽	라 대	ls V							
A 9.042 9.02 0.02 B 0.043 9.32 0.10 C 0.074 0.64 1.04	0.001 0.003 2.06 0.004 0.003 2.14 0.025M 0.035M1.6N	0.003 2.06 0.003 2.14 0.035M1.6N	8.07 12.58 8.40 12.72 5.4N 15.7N	1.11 - 0.96 - 1.68	0.35\						
INILIAT I H											
1. 1706 (1204) 1 Ht, Arr Co 1; Refrigerated	r Ce 1; Re	frigerated		11), 16 Hrs: Aged	at -110f (1921), 16 Hrs: Aged 1000f (811E), 1 Hr, Air Cool	r, Air Cool					
2. 1921F (1323), 15c (112); 841I (723K),	111. 1; 84	ш (723К).	3 Er.								
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STANNESS STEEZ: ANSSS, AFC 77, AFC 266 (Sheet	AFC 266 (She	pet 1 of 2	.	Table 22	7				-		
	Ccmpo-			Yiold	Typical	/K _{IC} ²	e Spe	Spectmen	-		
Form	Heat Freat-	Test Orientz- tien	renp PF (9K)	Strongth KS1 (MN/m ²)	RSIVID (MN/m 2	$) \begin{vmatrix} 2.3 \left(\frac{\sigma}{\sigma y_S} \right) \\ & \text{in (am)} \text{Type} \end{vmatrix}$	Trickness	Width in (mm)	Cruck Lengtu in (2001)	Ref	
AUSSS Plate: 6.5 in (12.7 m) Thick	۸,1	T-4	-50(228)	178(1227)	80(88)	0.505 /17.8) Be	0.505 /11.8) Bend 6.775(19.7) 6.793(20.1)	.793(20.1)	0.22 (5.6)	h	
-		r-1	-100(200)	180(1241)	54(59)	0.225 (5.7) Bt	Bead 0.775(19.7) 0.793(20.1)	.793(20.1)	0.22 (3.6)	·	
Plate: 0.625 in (15.9 nm) Thich	Α,2	וי-1	70 (294)	201(1386)	74(81)	0.339 (8.6) Be	Bend 0.628(15.9) 1.0	.0 (25.4)	1	20	
Forging: 9x9 in (230 x	8,3	1-1	70 (294)	167(1151)	63(69)	0.356 (9.0) CC	1.0 (25.4) 9.0	(0.22) 0.	1.5 (38.1)		-
230 mm)		L-1	-110(193)	203(1400)	24(70)	0.35 (8.9) CC	0,375(9,5)	(751) 0'9	0.5 (12.7)	-	
A.C. 77											
Bar: 3 in (76.2 nm) Dia	C,4	L-R	70 (294)	222(1531)	74(81)	0.278 (7.1) Be	Bend 0.48 (12.2) 1.5	.5 ("8.1)	;	<u>6</u>	
Air Meited		R-L	70 (294)	210(1418)	(92)(29)	0.270 (6.9) Be	Bend 0.39 (1) 0	0.39 (1)			
	C,5	L-R	70 (294)	(0161)222	106(117)	0,366 (9,3) Re	Rend 9.48 (12.2) 1.5	.5 (38.1)			
Plate: 0.56 in (14.2 km) Thick	9*2	7	70 (294)	290(1379)	110(121)	0,75 (:9.1) 8e	Rend 0.5 (12.7) 1.5	(38.1)	0.5 (12.7)	2	
AFC 260											
Plate: 0.55 in (14 rm) Thie'.	D,7	7	75 (297)	206(1420)	(66)06	0.477 (12.1) Fend 0.5 (12.7)		1.5 (38.1)	!	114	-
COMPOSITION											
C Si III S	<u>~1</u>	Ni Gr	읡	21 01 >1	Îŝ						-
A 0.113 7.32 1.08 0.006 B 0.12 0.44 1.21 0.009 C 0.16 0.13 0.18 0.021 D 0.0, 0.30 0.34 0.012	0.012 0.015 0.015 0.015	4.06 15.0 4.49 15.0 0.21 14.0 1.94 15.0	08 2.82 02 2.76 0 5.02 4 4.3	0.23 13.41 0.04 13.0 0.04	0.14						
HEAT TREATIENT									-		
1. 1710F (1206K), Mater Quench; -100F (200K), 3 Hr; Age 1000F (811K), 3 Hr 2 1710F (1206K), 10 min; Temper 925F (770K), 3 Hr 7. 1925F (1325K), 0.5 Hr; Oll Quench; -100F (200K), 3 Hr; Temper 850F (728K), 011 Quench; -100F (200K), 3 Hr, 850F (728K), 1 Hr, Air Gool 4. 1900F (1311K), 1 Hr, Oll Quench, -100F (200K), 0.5 Hr; Temper 800F (700K), 015 Gool	ich; -100F (impar 925F (il Quepch; - i 3 lir, 850F Quench; -10	200K), 3 1 770K), 3 1 100F (2001 (728K), 3 0F (200K)	lr; Age 1000 ir (), 3 lr; Te llr, Air Co , 0.5 llr; Te	7 Temper 850F (728K), 2 Hr; Cool Temper 800F (700K), 2 Hr; Temper 800F (700K), 2 Hr	2 Hr; 2 Hr + 2 Hr,	35<			-		
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STAINLESS S72EL: A4355, NFC 77, AFC 260 (Stoot 2 of 2)

Table 22 (Cont.)

National Department of the Control of the Second	Crack	Length	in (am)	The state of the s
pecimen		Width	ii (III	
03		Thickness	in (mm)	A STATE OF THE PERSON NAMED IN COLUMN NAMED IN
	L.		Type	
/ /KE }	2.5	, ys	in (mm)	
Typical	· ·	?*	KSIVIn \MN/m 2	The state of the last of the l
Vield	Strength		KSI (NW/m²)	
		1,13	, E)	
		_	ŭ.	
	Test	Prienta-	tion	
Compo- sition,	Heat	-Jiseit-	merr	
			Form	

Ref

HEAT TREATMENT

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2000f (1367K), 1 Hr, 011 Quench; -100f (200K), 0.5 Hr, 7 temper 500f (533K), 2 Hr, 10% Cold Reduction by Rolling; Temper 700f (544K), 2 Hr + 2 Hr, Air Gool Cold Rolled from 1.12 in (28.7 mm) Plate to 0.56 in (14.2 mm) in 5 steges with Intermediate Anneal, 1400f (1538K); 1800-1875f (1255-1297K), 1 Hr, 011 Quench; -100f (200K), 0.5 Hr, Temper 500f (533K), 2 Hr + 2 Hr
2.00f (1478K), 1 Hr; 1900f (1311K), 1 Hr, 011 Quench; -320f (76K), 1 Hr, 1000f (811K), 2 Hr + 2 Hr

7.

STEEL: ABS-C, ASIM A203 Grade A	203 Grade /	<u>د</u> ده					Table 23							
		Compo-	Compo- ition.				Yınıld	Typical	/K _{IC} \		Sp	Specimen		
		± ;			-		£		2.5(0)			3	Creck	
Fort			mcnt - 5	tion	(Ye. 36)		KS1 (?!X/m²)	KSIVÍn (MV/m - ž)	in (man)	Type	inickness in (mm)	Widtr. in (mm)	rength in (mm)	Ref
A05-C 1 in (25.4 mm) Thich.) Thick.	۸,1		<u>-</u>	70(294)	39								22
Si-Al Killed					-210(138)	09	60(414)	43(47)	1.28 (32.6)	Bend	1.28 (32.6) Bend 1.0 (25.4) 3.0 (76.2)	3.0 (76.2)	1.6 (40.6)	
				L-1	-275(103)	94	94 (648)	25(27)	0,177(4,5)	Bend	Bend 1.0 (25.4)	3.0 (76.2)	1.6 (40,6)	
				. :-1	-321 (77.2)	116	116(809)	23(25)	0.098(2.5	Bend	Bend 1.0 (25.4)	3.0 (76.2)	1.6 (40.6)	
A203 frade A Plate: 1.65 in (42 mm) Thick	n) Thick	B, 2		:	-260(144)	59	65 (448)	51(56)	1.54 (39.1)	ឯ	1.645(41.8)	:	:	102
				. T-3	-250(11.2)	7.7	77(531)	39(43)	0,641(16,3)	៦	1.645(41.8)	;	:	
		B, 3		. T1	-250(112)	20	50 (621)	57 (62)	1,002(25.5)	ե	1,645(41,8)	i	į	 -
				L-T	-300(88)		;	41(45)	:	ե	1,645(41.8)	:	:	
A203 Grade B Plate: 2 in (50.8 mm) Thick) Inick	, C,2		ن	-150(172)	19	61(421)	38(42)	0.970(24.6)	ti	2.0 (50.8)	;	i i	102
				:	-290(144)	70	70 (483)	37(41)	6,698(17,7)	៦	2.0 (50.8)	:	ł	
		۲,3		T-1	-300(88)		i	39(43)	:	t	2.0 (50.8)	:	;	
COMPOSITION														
되	اء	s:	Si	긺	Cr %	3 	된							
A 0,20 0,60 B 0,14 0,51 C 0,11 0,45	0.009 0.914 0.010	9.022 C	0.023 0.18 0.23	0.02 2.35 3.35	0.07 0.	0.01 0.03	3 0.057							
HEAT TRLATMENF														
1. 1650F (1172K), 1 Hr, Air Cool 2. Normalized 3. 1650F (1172K), 2 Hr, Mater Sprov Quenched; Tempered 1150F (894K), 2 Hr, Air Cool	, 1 Hr, Air , 2 Hr, Kat	Cool er Sprøv	Quenche	жi; Тепр	ered 1150	F (894K),	, 2 Hr, Air C	100						
							, C. C.	v						·
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Table 24

STEEL:	STEEL: Low Strength: AISI 1045	th: AL	SI 1045						1	Table 24							
				ပ်	Combo-			\vdash			1ypica1	/Krc \		ďS	Specimen		
	1			; = <u>;</u> ;	Sition, Heat Trust	lest o renta-	lon;		Strength		-3 N/m 2	(.4	Type	$(1.5(\frac{1}{\sigma_{1}}))$ Thickness in (mm) Type in (mm)	Width in (mm)	Cruck Length in (mm)	Ref
ylate:	1912 1 in (101.6 mm) Thick	. (mm 9	hick		۸,1	7	25 (269)	_	(637) GE		46 (50)	5.5 (88.9)	MOL	3.5 (88.9) NOL 4.0(101.6) 10.22(260) 4.08(104)	10.22(260)	4.08(104)	돢
						L-T	0 (256)	•	40 (276)	(9)	46 (50)	3,7 (84,1)	NOL	3. (84.1) NOL 4.0(101.6) 10.22(260) 4.08(104)	10,22(260)	4.08(104)	
COMPOSITION	NO1.														-		
	ان دا	뒤	<u>~1</u>	νI	3.1	Ξĺ	ئا اد	위	3	>1	디						
<	0.52 0	0.83 0	0,006	0.028 0.25	0.25	0.12	<0,10	0.03	0.29	<0.0>	*0.01						
HEAT FREADHLNT	APMLNT																
	1. Normalized; Heated to 1700F (1200K), Air Cooled	l; Heate	d to 13	700F (124	00K), A	vir Coole	Ŋ.								-		

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TCE1 . ACTO! A016

STEEL: ASTH A216	516							Table 25	25						
			3,0	Compo-				Yield	Typical	/K _{IC} ²	_	55	Specimen	# my c+ community	<u> </u>
	Form		F		Test Orienta- tion	, 1 . 1 .	(° K)	Strongth KSI (MV/m²)	KS IVIT (NA /m - 27)	$2.5\left(\frac{1}{\sigma_{ys}}\right)$	Туре	Thickness in (FT)	Width in (mm)	Crack Length in (mm)	Ref
A216 WCC Grode Casting: Z0 x 48 in	20 x 48 in	1	4	Α,1	,	-50(228)	28)	\$5 (379)	(63)06	6.694(170)	TOM	6 (152)	15.3 (389) 6.5 (165)	6.5 (165)	103
90c)	77 X 90C X	Ē				-100(200)	(00	61(421)	49 (54)	1.613 (41)	NOL	2 (50.8)	5.1 (130)	2.08 (53)	
						-150(172)	72)	67 (462)	48.(53)	1,283(32,6)	KOL	2 (50.8)	5.1 (130)	2.12 (54)	
						-200(144)	44)	77(531)	33(36)	0.459(11.7) hOL	NOL	2 (50.8)	5.1 (130)	2.11 (54)	
COMPOSITION	•														
ul	된		v.i	Si	ž	5	위	V							
A 0.24	1.15	800.0	0.011	0.44	0.37	60.0	0.02	90.0							
HEAT TREATHERT															
1, 1650F 1750F 200F (3	(1172K), 8 (1220K), 8 367K), Temp	Hr, Fur Hr, Fur er 1200	mace Co rrace Co)F (922)	001 600 001 to 0), 8 Hz	F (589K) 1650F (1) r, Air C	; 1125F 172K), 1 201	(8R1K) Equaliz	1650F (1172K), 8 Hr, Furnace Cool 600F (589K); 1125F (8R1K), Furnace Cool 65G: (589K); 1750F (1226K), 8 Hr, Furnace Cool to 1650F (1172K), Equalize; Accelerated Cooling to 200F (367K), Temper 1200F (922K), 8 Hr, Air Cool	650: (589K); Cocling to						

				Compo-			Yield	Typical Kee	/ ^K IC \ ²		Sp	Specimen		
	_	Fo		Heat Treat-	Test Orienta-	des l		$\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$	$\left(\frac{2.8\left(\frac{\sigma}{\sigma_{ys}}\right)}{10.000}\right)$	Thicknes	Thickness in (mm)	Width in (am)	Crack Length	Ref
Plate:		1 in (25,4 mm) lhick	ick	۸,1	1-1	-150(172)	4	47 (52)	1.31 (33.2)	┨ ̄	1	1	1.6 (40.6)	°.
					1-1	-200(144)	73 (503)	32 (35)	0.48 (12.2) Bend	nd 1.0(25.4)		3.0(76.2)	1.6 (40.6)	
					L-1	-250(112)	89 (614)	25 (27)	0.197 (5.0) Be	Bend 1,0(25,4)		3.9(76.2)	1.6 (40.6)	
					7	-321 (77)	123 (848)	23 (25)	0.087 (2.2) Be	Bend 1.0(25.4)		3.0(76.2)	1.6 (40.6)	
Plate:		7 in (178 mm) Thick	çk	8,2	T-L	0(256)	50 (345)	53 (58)	2.8 (71.3) WOL		4.0(101.6)	4.5(114.3) 2.0 (50.8)	2.0 (50.8)	Ξ
					7-1	-100 (200)	63 (434)	45 (49)	1.28 (32.4) NOL		4.0(101.6)	4.5(114.3) 2.0 (50.8)	2.0 (50.8)	
					T-L	-200(144)	85 (586)	34 (37)	0.40 (10.2) WOL		2.0 (50.8)	2.25(57.2) 1.0 (25.4)	1.0 (25.4)	
					T-L	-321 (77)	140 (965)	26 (28)	0.086 (2.2) NOL		2.0 (50.8)	2.25(57.2) 1.0 (25.4)	1.0 (25.4)	
				c,3	LT	-25 (235)	61 (421)	76 (83)	3.88 (98.6) WOL		6.0(152.5) 8	8.63(219) 3.0 (76.2)	3.0 (76.2)	104
					L-T	-200(100)	82 (565)	42 (46)	0.656 (16.7) CT		1.0 (25.4)	2.0 (50.8) 1.0 (25.4)	1.0 (25.4)	
					L-1	-250(112)	(929) 86	31 (34)	0.25 (6.4) CT		1.0 (25.4)	2.0 (50.8) 1.0 (25.4)	1.0 (25.4)	
				D, 2	T-1	-100 (200)	60 (414)	40 (44)	1.11 (28.2) WOL		4.0(101.6)	4.5(114.3) 1.5 (38.1)	1.5 (38.1)	105
					3	-200(144)	80 (552)	30 (33)	0.35 (8.9) NOL		2.0 (50.8)	2.25(57.2) 0.75(19.1)	0.75(19.1)	-
					[-]	-321 (77)	130 (896)	27 (30)	0.11 (2.7) NOL		4.0(101.6)	4.5(114.3) 1.5 (38.1)	1.5 (38.1)	
COMPOSITION	1T10N													
	ပါ		ωI	ઢા	읽	Ni Cr	당 당							
< 20 U S	0.21	1.35 0.0	0.017 0.014 0.015 0.010 0.013 0.014	0.16	0 49 0 0.50 0	0.03 0.97 0.04 - 0.16 0.21	0.03 0.010							
a	0.21		010 0.010											
HEAT T	HEAT TREATMENT													-
-2:	1650F (Normall: 1200F (S	1650F (1172K), 70 c Normalize 1650F (1) 1200F (922K), 7 Hr	minutes, A: 1172K), 7 Hi	ir Cool r, Fan Co	ol to 200	F (367K), A	1650F (1172K), 70 minutes, Air Cool Normalize 1650F (1172K), 7 Hr, Fan Cool to 200F (367K), Air Cool; Striss Relieve 1200F (922K), 7 Hr	elieve						

1200F (922k), 7 Hr. Stress Relieve 1200F (922K), 7 Hr; Fan Gool to 800F (700K), Air Cool 3.

是一个人,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就 第一个人,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就是我们的,我们就

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Strength:
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STEEL: Low Strength: ASTM A533 (Sheet 1 of	Sheet 1 of	33		Table 27							
	Compo-			Yield	Typical	/K1C \2	<u> </u>	dS	Specimen		
	Heat Treat-	Test Or ienta-	des t	Strength)	$\left(\begin{array}{c} 2.5\left(\frac{1}{y_S}\right) \end{array}\right)$		Thickness	Width	Crack Length	
Form	ment	tlon	9F (0K)	KSI (MN/m ²)	KSIVIn \MN/m 4	In (mm)	Type	in (man)	in (mm)	In (mm)	Ref
ASTM A533, Grade B, Class 1 Plate: 12 in (305 mm) Thick	Α,1	:	50 (284)	70 (483)	*140(153)	10 (254)	៦	12 (305)	24 (610)	12 (305)	106
		L-T	(562) 57	73(503)	•105(115)	5.17 (1.31)	t	10 (254)	20 (308)	10 (254)	
		L-1	0 (256)	75 (517)	* 75(83)	2.5 (63.5)	ಕ	6 (152)	12 (305)	6 (152)	
		T-7	-25 (235)	77(531)	• 57(62)	1.37 (34.8)	ರ	4 (102)	8 (203)	4 ,.02)	
		L-T	-100(200)	79 (545)	* 48(53)	0.92 (23.3)	ಕ	4 (102)	8 (203)	4 (102)	
		L-T	-150(172)	86 (593)	* 40(44)	0.54 (13.7)	b	4 (102)	8 (203)	4 (102)	
		L-T	-200(144)	95 (655)	• 38(42)	0.40 (10.2)	5	4 (102)	8 (203)	4 (102)	
-		L-1	-250(112)	111 (765)	* 37(41)	0,38 (7.1)	TOM	1 (25.4)	1.25(31.8)	0.53(13.5)	
Plate: 12 in (305 mm) fhick	8,2	L-1	-200(144)	85 (586)	33(36)	0.38 (9.7	TOM	1 (25.4)	1,25(31.8)	0.5(12.7)	107
		L-T	-250(112)	93(641)	29(32)	0.24 (6.1)	TOM	1 (25.4)	1,25(31.8)	0.5(12.7)	
		L-T	-321(77)	124(855)	26(28)	0.11 (2 8)	TOM	1 (25.4)	1,25(31,1)	0.5(12.7)	
Plate: 11.75 in (298 mm) Thick	6,3	L-1	0(256)	77(531)	86(95)	3.12 (79.2)	t	4 (102)	8 (203)	4 (102)	306
		L-1	50(228)	82 (565)	75(82)	2,09 (53,1)	₽.	4 (102)	8 (203)	4 (102)	
		L-T	100 (200)	85 (586)	55(60)	1,05 (26.7)	៦	3 (76.2)	6 (152)	3 (76.2)	
		L-T	-200(144)	95 (655)	45 (49)	0.56 (14.2)	t	2 (50.8)	4 (102)	2 (50.8)	
		L-1	-321(77)	143(986)	38(42)	0.18 (4.6)	៦	1 (25.4)	2 (50.8)	1 (25.4)	
Plate: 6 in (152 mm) Thick	B,2	L-1	-150(172)	71 (490)	38(42)	0,716(18.2)	TOM	1 (25.4)	1,25(31.8)	0.5(12.7)	107
		L-1	-250(112)	102 (702)	33(36)	0,262(6,6)	MOL	1 (25.4)	1,25(31.8)	0,5(12,7)	
		7	-320(78)	129 (889)	34(37)	6.174(4.4)	H)[1 (25.4)	1,25(51.8)	0.5(12.7)	
				1							
*Mid-Thickness Values				41×	V						

STEEL: Low Strength: ASTM A533 (Sheet 2 of 2)

(Table 27 (Cont.)

			Compo		F		-									
			sition					Yield	_	No cal	/K _{16.} \		ds	Specimen		
	Form		Treat- ment	Test Orienta-		lemp Pr		Strength		$\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$	2.5(0 /ys)		Thickness	Width	Crack Length	
COMPOSITION					-{		┨	11 / Au . A	1	ASIVIT (MA) II V	in (mm) Type in (mm)	Type	in (mm)	in (TEI)	in (mm)	Ref
< 40 C	C Mn 0.24 1.42 0.18 1.25 0.23 1.35	P 42 0.010 25 0.024 35 0.012	5 0.017 0.025 0.025	Si 0.22 0.24 0.26	NI 0.70 0.52 0.50	0.50 0.51 0.48	기	0.29 0.29	A1 - 0.025							
1. Norma	1. Normalize 1675 ±25F (1186 +14K): Austernities 1600 stone const.	25F (1186 -	+147). Aus		997			į								

5.

Normalize 1675 ±25F (1186 ±14K); Austenitize 1600 ±500F (1144 ±28K), 4 Hr, Water Quench; Temper 1225 ±25F (936 ±14K), 4 Hr, Furnace Cool; Stress Relieve 1150 ±25F (894 ±14K), 4 Hr, Air Cool
Austenitize 1650F (1172K), 1 Hr; Temper 1200F (922K). 8 Hr; Stress Relieve 1100F
(894K), 24 Hr,
Normalize 1675 ±25F (1186 ±14K); Austenitize 1600 ±50F (1144 ±28K), 4 Hr, Water Quench; Temper 1225 ±25F (936 ±14K), 4 Hr, Air Cool; Stress Relieve 1135 ±25F (886 ±14K), 4 Hr, Air Cool; Stress Relieve 1135 ±25F (886 ±14K), ь.

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COMPOSITION

HEAT TREATMENT

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1,25(31.8) 0,53(13.5)

1,75(31.8) 0.53(13,5)

1 (25,4)

0.156(4.0) NOL.

5,441(17.2) NOL

0.53(13.5)

1,25(31.8)

1 (25.7) 1 (25,4)

,16 (29.5) WOL

1.2°(31.8) 0.53(17.5) 1.25(31.8) 0.° 5(13.5)

1 (25,4)

₹., Š

0.297(7.5 0, 113 (2.9)

40 (44) 30 (3.5) 75 (82) 50 (55) 35 (9)

-320(78)

.200(144) 250(112) .320(78)

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B, 2

Plate: 12 in (205 mm) Thick

250(112)

<u>--</u>1 Ĭ-,

B,2

ASTN A543 Plate: 6 in (152 mm) Thick

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1 (75,4)

1 (25.4)

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Ref

Crack Length in (14m)

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Thickness in (mm)

in (mm) 1y;e

KSIVIn (MN,m 2)

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Low Strength: ASTM A542 and ASTM A543

STEEL:

Specimen

107

1.25,31.8; 0.55(13.5)

1 (25.4) 1 (25,4) 1 (25.1,

0,302(7.7) KOL

11 (15) 55 (38) 29 (52) (94) 69 54 (38) 30 (33)

1,25(31.4) 0,53(13.5) 1,25(31,4) 0,53(13.5) 0.53(13.5) 0.53(13.5) 0.53(13.5)

1,25 (31.8) 1,25(31.8) 1,25(31.8)

1 (.5.4) 1 (25.4)

0.932(23.7) 50L

Š

0.176(4.5) 0,092(2,3)

ĬĞ.

0,38 (2.2)

101

0.176(4.5)

. 250 (112)

.320(78) -200(144) -250(112) -320 (78)

٨,١

Plate: 12 in (305 mm) Thick

-25,0(.44)

<u>-</u> [-] : -[-]

۸,۱

ASTM A542 Plate: 6 in (152 mm) Thick

Form

3
4

1 1 m

	The state of the s														
			Compo-				, Xio	14	Typica1	/AIC \2		łs	Specimen		
Ĕ	Form		Heat Test Treat- Orienta-	1est Orienta	- ;-	l emp P (A o K)	Strength KS1 cMV/m ²)		$\frac{1}{\text{ASIVin}} \left(\frac{3}{\text{MN/m}^2} \right)$	$\frac{2.5(\frac{1}{9})}{\text{in (mm)}}$		Thickness Type in (man)	Width in (mm)	Cruck Length in (mm)	Ref
AISI 1144 Forging: 4 in (102 mm) Thick	(102 mm) Thi	ž	1,4	2	75 (75 (297)	78 (538)	18)	61 (67)	1.53(38.9) WOL	JG.	4 (102)	10.2 (259)	3.7 (94)	\$
				1-1	0	0 (256)	78 (538)	(8)	52 (57)	1.11(28.2) WOL	MOL	4 (102)	10.2 (259)	3.7 (94)	-
11Y-80 Plate: 1 in (25.4 mm) Thick	.4 mm) Thic	.	B, 2	I-1	-320 (78)	(78)	143 (986)	(9)	(99) 09	0.440(11.2)	Bend	1 (25.4)	0.440(11.2) Bend 1 (25.4) 3 (70.2) 1.6 (40.6) 10	1.6 (40.6)	01
COMPOSITION															
د)	됬	اے	s i	is!	N.	Cr %	>l ol	디	긺						
.0 8	0.52 1.46 0.16 0.28	0.016	0.025 0.016	0.20	2.26 1	1.46 0.30	.30 0.00	0.005 6.005	0.016						
HEAT TREATHENT															

1550F (1117F), 6 Hr, 911 Quench; 900F (756K), 6 Hr, Furnace Cool.
 1666F (1178K), 92 minutes, Mater Quench; 1300F (978K), 87 minutes, Mater Quench.

		Compo-			Place	Typical	/K1C \2		ls	Specimen		
For	:	Tr. it-	Orice 1-	Print, (A.)	~ <u>~</u>	$\int_{\text{ASIVIII}} \left(\frac{3}{\text{MV/m}} \right)$	$2.5\left(\frac{1}{\sigma_{yS}}\right)$ in (mm)	1ype	Thickness in (mm)	Width in (mm)	Crack Length in (mm)	Ref
ASTN A469 Forging: 31 in (787 mm)		۸,1	-7 R	50(283)	88(607)	120 (131)	4.65 (118)	NO.1	4 (102)	4 (102) 10.2(259)	4 (102)	801
ma, is in (38) Thick	1 1111.)		1-R	0(256)	\$0 (621)	(22) 02	1.51 (38. ,) NOL	NOI.	2 (50.8)	5,1(130)	2 (50.8)	
			L-R	-100(200)	(559) 56	35 (38)	0,339(8.6)	Cr	; (25,4)	2 (50.8)	1 (25.4)	
			1-R	-200(144)	105 (724)	27 (30)	0.165(4.2)	b	1 (25.4)	2 (50.8)	1 (25.4)	
			L-R	-320(78)	150(1034)	25 (27)	0.069(1.8)	5	1 (25.4)	2 (50.8)	1 (25.4)	
Ni-Mc-V Forging: 38 in (965 mm) Dia.	Dia.		с . я	150 (339)	80 (552)	70 (77)	1.914(48.6) NOL	NOL	4 (102)	10,2(259)	3.6(91.4)	105
			C-R	70 (294)	90(621)	50 (50)	0.772(19.6) NOL	NOI.	3 (76.2)	7,7(196)	2,7(68.6)	
			C-R	0(756)	95 (655)	40 (44)	0.443(11.3) KOL	KOL	2 (50.8)	5.1(130)	1.8(45.7)	
			~ 5	-100(500)	100(690)	30 (33)	0,225(5.7)	kOI.	2 (50.8)	5, i(130)	1.8(45.7)	
-			د -5	-200(144)	110(758)	25 (27)	0.129(3.3)	KOI.	1 (25.4)	2,6(66)	0.9(22.9)	
			ĕ-5	-320(78)	140 (965)	23 (25)	0.067(1.7)	NOI.	1 (2' 1)	2,6(66)	0.9(22.9)	
COMPOSITION												
C	۵l	S	N.	5	>i 8i							
0.20 0.55 0.23 0.50	0,010	0.009 6.	6.19 2.96 0.21 3.4	0.18	0.29 0.08							
IFAL FREATHENT												

1. 1520F (1100K), 1180f (910K), 40 Hr.
2. 1475F (1075K), 20 Hr, furnace Cool to 600F (589K), Hold 30 Hr; 1640F (1166K), 30 Hr, Air Cool to 530F (550K), Hold 30 Hr; Temper 1130F (883K), 40 Hr. ' ' ' ace Cool to 400F (478K), Air Cool

ASTM A470 Forging: 15 in (381 mm) Dia. A, 1	Yreid Streng"s Streng"s Streng"s Streng Streng	Typical $\frac{K_{IC}}{K_{IC}}$ KSI $\sqrt{10}$ $\left(\frac{-\frac{3}{2}}{10/m}\right)$		Spo Thickness in (mm)	Specimen kidth	Crack	
Form		^k 1C KSIVIn (4N/m ⁻³)		Thickness in (mm)	kıdth	Crack	
Form Tr. 12 - 0) 10 - 3- 15 in (381 mm) Dia, A, 1		KSIVIn (MV/m ⁻²)		111 (mm)	(02)		
15 in (381 mm) Dia, A, 1 L-R 11 L-R			ın (mm) Iype		,,	111 (mm)	Ref
15 10 (361 mm) 7.11. [-R [-R -1 [-R -1] [-R -1]		84 (92)	2,28 (57.9) NOL	4 (102)	10,2(259)	4 (102)	108
1R 1R -1 1R -2 1R -3		50 (55)	0.723(18.4) MOL.	4 (103)	10.2(259)	4 (102)	
1. 11 - 1 1. 12 - 2 1. 18 - 3		40 (′)	0,443(11,3) NOL	1 (25,4)	2,55(64.8)	1 (25,4)	
L-R -2 L-R -3	0(200) 105(724)	30 (33)	0.204(5.2) MOL	1 (25.4)	2,55(64.8)	1 (25,4)	
E	0(144) 120(827)	25 (27)	0.109(2.8) NOL	1 (25.4)	2,55(64.8)	1 (25.4)	
2 e		23 (25)	0,052(1.3) WOL	1 (25.4)	2,55(64.8)	1 (25.4)	
	70(294) 83(573)	(92) 69	1.738(44.1) Bend	4 (102)	4 (102)	1 (25.4)	109
C,:-R		65 (71)	1.650(41.9) Bend	6.7(170)	6.7(170)	1.6(40.6)	
NOT 1 1 (A) NOT 1							
C Nn P S Si Ni Cr	Cr No						
78 0.009 0.010 0.28 0.07	1.10 1.15 6.26 1.0 0.7 0.32 1.2 1.1 0.37						
HEAT FREADMENT							
1, 17'5F (12'12K), 1240F (944K), 40 Hr.							
		>9₽					

Ni -Cr-40-V
and
A:171
YSLY
Strength:
Intermodiate
E.:

STEEL: Intern	Intermodiate Strength:		l A471 an	ASTM A471 and Ni-Cr-Wo-V	۸-,		Table 32							
			Compo-	!		H	11014	Typica.	/K1C 2	_	ls	Specimen		
	Form		Heat Treat-	lest Oriena- tion	-	(Y)	Strangth 1-st (*18/n*)	11 (3) (12 (13) (13) (13)	$\frac{2.5\left(\frac{1}{\sigma_{yS}}\right)}{\text{in (mm)}}$	lype	Ihickness in (mm)	kıdth ın (Em)	Crack rength in (mm)	Ref
ASTM A471 Forging: 60	60 in (2524 mm) Dia.	. s	۸,1	1-1	(250)	<u>.</u>	115 (793)	155 (170)	1,54 (115)	NOI.	4 (102)	10.2 (259)	4 (102)	108
				fR	-100(200)		125 (862)	100(110)	1.6 (40.6) WOL	MOI.	; (76.2)	7.7 (196)	3 (76.2)	
				L-R	-200(144)		140 (965)	(99)09	0,459(11,7) wol.	MOI.	3 (76.2)	7.7 (196)	3 (76.2)	
				- H	-320(78)		180(1241)	35 (38)	0,095(2,4)	NOI.	3 (76.2)	7.7 (196)	3 (76.2)	
Forging: 65	65 in (16'		8,1	1R	200 (367)		140 (965)	150(164)	2.86 (72.6)	cr	4 (162)	8 (203)	4 (102)	
x 27 i	x 27 in Thick			L-R	70(294)	•	155 (1069)	(66-)06	0,842(21,4)	CF	2 (50.8)	4 (102)	2 (50.8)	
				IR	0 (256)		165 (1138)	65(71)	0,388(9,9)	5	2 (50.8)	4 (102)	2 (50.8)	
				<u>-</u>	-100(200)	<u>-</u>	170(1172)	58(64)	0,291(7.4)	נו	2 (50.8)	4 (102)	2 (50.8)	
				L-R	-200(144)	=	(1571)081	45(17)	0,143(3,6)	CT	2 (50.8)	4 (102)	2 (50.8)	
				IR	-320(78)		205(1413)	25(-25)	0,031(0,8)	CF	2 (50.8)	4 (102)	2 (50.8)	
Ni-Cr-40-1 Disc forging			۲,	 *-	70 (294)	<u>-</u>	109(752)	(6b-)06	1.7 (43.2) Bend	Bend	5.66(144)	5.66(144)	1.3(33)	10%
				7-, 8-,	-104(198)	2	117 (807)	\$8(-64)	0,614(15.6) Bend	Bend	3 (70.2)	3 (76.2)	0.9(22.9)	
			<u>,</u>	IR	-71(213)		117(807)	83(91)	1,258(32)	Bend	s (127)	\$ (127)	1.1(27.9)	
COMPOSITION														
) [۵.1	ω!	Si	t)	위	>1							
< # U a	0.21 0.28 0.27 0.35 0.28 -	0,005	0,012 0 0,009 0	0.04 3.51 0.04 3.48 - 2.4 - 3.3	1 1.64 8 1.47 0.8 1.6	0.39 0.40 0.5 0.6	0.11 0.13 0.1 0.15							
HEAT TREATMENT	-													
1. 1550F	1. 1550F (1117k), 1090F (862K), 40 Hr.	: (862K),	40 Hr.											

Commence of the second of the

SIELL: Intermediate Strength: ASTM AS17-F and HY130

是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人, 第一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人,我们是一个人

Stall, Intermediate Strength; ASTM AS17-F and HY130	ite Strength:	ASTM AS17-F	and 11Y13t		Table 33	33							
		Corpo-				- - -	lypical						
		11 11	_		Strength		KIC	- (); (); ()	-	Spc	Specimen		
Form	-	Frest meat	4 S	- 1.	<u></u>		$\left(\frac{1}{881\sqrt{11}}\left(\frac{3}{388/m}-\frac{3}{2}\right)\right)$			lhick, ess	hıdth	Crack Length	
ASIM AS17-F					·			7	2 S	าท (ก.ศ.	111 (mm)	រព (ព.៣)	Ref
Plate: 1 in (25.4 cm) Thick, Open Bearth Melted	em) Thick, h Melted	Α,1	Ξ	-1007200)	127 (876)	7.	75 (82	0.872(22.1) Bend	I pua	1 (25,4)	3 (76.2)	1 6(46 1)	5
			-	-165 (162)	133(917,	Š	53 (58)	0.397(10.1) Bend	nd 1			(1.04)31	
			1-1	(111)007-	139 (958)	÷	47 (51)	0.28c(7.3) Bend				(1.0,10.1)	
9.2			<u> </u>	-320(78)	171(2200)	35	35 (38)	0.101(2.6) Bend				1.6(40.1)	
Flate: 1 in (25.4 mm) Inick,	mm) Inick,	8,2	-	-250 (112)	165 (1158)	98	so (88)	0.588(14.9) B nd		1 (25.4)	1 (76.2)		5
COMPOSTITON			3	-320(78)	190(1310)	23	13 + 17)	0.128(5.3) Bend				1.6(40.1)	
A 0.17 B 0.11	0.78 0.85	9 Si 0,012 0,017 0,23 0,009 0, 207 0,23	Z \$	0.56 0.42	12 0.036 0.003	है।	11 0,035 0,021						
HAT IRLADUAT													

1660f (1178K), 70 minutes, hater Quench; 1230f (939k), 9; minutes, hater Ouench, 1500f (1089k), 93 minutes, hater Quench; 116 H (890k), 93 minutes, hater Quench, *∹ ;*;

TITANIMI.	M. # Alloy: 5A1-2.5	. Sn					Tal	Table 34							,	
			Compo-						Typical	-	/Krr\ ²		S	Specimen		
	,		Heat Treat-	Test Orienta-	· -	 پو	Strengt .		"1c (-3)	w.k	۲,		Thickness	Width	Crack Length	;
1	Fara	-	ment	tion	(o _K)	3	KSI (MN/m")		KS:√in \	MIN m	in (mm)	å	(r.) uj	in (mm)	in (sg.)	Ref.
Plate:	0.5 in (12.7 mm) Thick	ıtck	۸,1	J7	-320(78)	(8/	175(1207)		65 (71)		0.345(8.8)	Bend	0.250(6.4)	0.500(12.7)	:	13
				T-E	-320(78)	78)	(6211)121		50(55)	_	0.214(5.43)	Bend	0.250(6.4)	0.500(12.7)	;	
<u> </u>				F.	-423(21)	21)	205(1413)	_	55 (60)		0.180(4.6)	Bend	0.250(6.4)	0.500(12.7)	;	
				T.L	-423(21)	21)	269(1441)	_	52(57)	_	0.155(3.9)	Bend	0.259(6.4)	0.500(12.7)	;	
Plate:	9.5 in (12.7 mm) Tidek	ijck	6,1	L-1	-320(78)	78)	203(1400)		26(28)	_	0.041(1.0)	Bend	0.250(6.4)	0.500(12.7)	1	35
	(and the state of			T-&	-320(78)	(8/	204 (1407)	_	50(55)	_	0.150(3.8)	Bend	0.250(6.4)	0.500(,3.7)	ł	
				L-1	-423(21)	21)	233(1606)	.ت.	25 (27)		0.029(0.7)	Bend	0.250(6.4)	0.500(12.7)	i	
Plate.	0.8 in (20.3 mm) Thick	ick	c,2	1 1	-320(78)	78)	173(1193)		(89) ک		0.321(8.2)	Bend	0.400(10.2)	0.400(10.2) 0.75 (19.0) 0.375(9.5)	.375(9.5)	36
				Ţ-	-423(21)	21)	187(1289)	_	(19)59		0.302(7.7)	Bend		0.400(10.2) 0.75 (19.0) 0.375(9.5)), 375 (9, 5)	
COMPOSITION	TION															
	4 1	41 5	Sn.	2	×!	ات	¥!	쓁	=1	01	×۱					
< # U	ο. κ.		2.6 0. 2.3 0. 2.50 0.	0.16 0. 0.34 0. 0.13 -	0.01 0.00.00.015 0.00.00.00.00.00.00.00.00.00.00.00.00.0	0.023 0.023 0.02	90000	0.01	0.001 0.017 94ppm	9.086 0.010 0.015 940ppm 70ppm	0.010 0.015 70ppm					
HEAT TRCATMENT	CATMENT															
<u> </u>	1500F (1089%) Furnace Cooled 1500F (1117K), 16 Hr, Furnace Cooled	iace Cool IIr, Furn	ed Ince Coole	rg.												
							49 <									
																ĺ

Table 35 TITANIIM, Mear a Alloys: IMI 679, IMI 685, 8A1-1Mc-1V, 6A1-2Sn-4Zr-Zio (Sheet 1 of 2)

-	And the desirable respective and the second	Compo-				Typical	2			•		Γ
		sirion,			Yield	Kır	/KIC)		Sp	Specimen		1
-	Form	Heat Treat- ment	Test Orienta- tion	Lemp (o.K.)	Strength KSI (MV/m²)	$\left(\frac{3}{\text{KSIVIn}}\left(\frac{3}{\text{MN/m}^2}\right)\right)$	2.5 (° y/s) (3m)	Type	Thickness in (mm)	width in (mm)	Crack Length in (min)	Ref
INI 679. Forying:	0.625 in (15.9 vm) Thick 8 Poscessed 2100F (1422X)	A, I	(a)	70(294)	141 (979)	31 (34)	0.119(3.0)	Bend	Bend 0.5(12.7)	i	ŀ	22
Porging:	0.525 In (15.9 vm) Thick a + 6 Processed 16752 (1186 K)	Α,1	(a)	70 (294)	153(1055)	26 (28)	0.072'1.8)	Bend	0.5(12.7)	į	:	-
Forgingi	i,25 (n (31,8 cm) Thick 8 Fwzed 1800f (1255K)	S . 3	(a)	70(297)	135 (931)	57 (62)	0,445(11.3) Bend		0.5(12.7)	;	ì	92
IMI 685 Bar: 3.7	1M1 685 Bar: 3,75 in (35 mm) Dia,	9*9)-'I	70(294)	137 (941)	64(70)	0.546(13.9) (b)	(a)	i	į	ł	121
5 G		E,7	D-1	70 (294)	143 (884)	55 (66)	0.370(9.4)	(9)	i	:	:	
Plate: 3.	3.7 in (18 rm) Thick, a + B Warked	8,3	Š	70 (294)	130 (896)	56(61)	0.464(11.8) (b)	(e)	ŧ	ì	4 4 1	
fi-841-Die	fi-831-1910-IV Pinte: T in (25.4 ma) Thick	5,2	7	70(294)	138 (951)	67(74)	0.589(15.0) SEN		0.87(22.1)	\$ (127)	1.7(43.2)	82
Forging:	0.625 in (15.9 am) Thick B Engineers and 2100F (1422K)	Ç, 3	(a)	70 (294)	126 (868)	57 (63)	0,512(13.0) Bend		0.5(1:.7)	:	;	22
Forking:	V.&ZS ir (15.f° am) Thick i + G'frocussed 1800F (1155K)	£ 13	(a)	70 (294)	145(986)	34(37)	0.167(4.3)	Ber.	Bers 0.5(12.7)	:	;	
6AE. 250-42 Forging:	6A5.250-16x-3% Forging: (7.7.5 in (15.9 mm) intok & Processed 21007 (1422K)	D,4	ઉ	70(294)	146 (1006)	52(57)	0.357 (8.1)	Bend	0.5(12.7)	į	i	22
Forging:	6,625 in (15.9 mm) Thick a + # Frucessed 1750F (1128k)	5,4	(a)	70 (294)	160(1103)	52(35)	0.100(2.5)	Bend	0.5(12.7)	i	i	
	-		=									
					L)	50 <						

TITANIUM, Near a Alloys: INI 679, IV; 685, 8A1-1M0-IV, 6A1-2Sn-4Zr-2M0 (Sheat 2 of 2)

		Ref	<u> </u>							
		Crack Length in (mm)								
		7.1								
		ڭ ئۆ								
	Speczerin	յում։ in (ատ)								
	Sp	ss (
		Thickness in (max)								
		Туре								
	KIC \	$\frac{s(\sqrt{\sigma_{ys}})}{\sin (mm)}$								
3	`	$\frac{2.5\left(\frac{\sigma}{\sigma_{ys}}\right)}{\sin (mm)}$								
Table 35 (Cont.)										
le 35		$\left \frac{1}{\text{KSIVin}} \left(\frac{3}{\text{MN/m}} \right) \right $								
Tah 1	Typical	71 (T			و		Ñ			
2)	_	KSIA		= 1	0.006		J.005			
2 of		# of		zi	0.013					
heat	icld	Strength ASI (3N/m²)			0.07		0.15	0.10N		0 3
S) 04	>	St. ASI		CI						20 ti
42r-2	H			υI	0.023	0.022	0.024	0.04M		Cool , Air Cool , Air Cool , 8 lir, Air Cool r Cool
-2Sn-		ten, de lo			_		80	× ×		III, A
. 6A1				S	0.21	•		0.12N		IF, Ai
No-1V		Test Orien'a- tion		의	0.06	0.0%	0.06	0.12M		24 H (867K (867K 100F), 24 Hr
8A1-1		ب د ت						S.0N		72K), 100F 100F 100F 8cd 1 (772K (772K 3K),
685,	Compo-	Heat Tr. 1t-		17	5.0	• 1	3,9	Š.		of (7 sh; 1 ch; 1 ch; 1 sh; A sh; A 730F 773X)
2	3 1	-F =		돐	11.1		2,1	NO. 11		0, 93 Quen Quen Quen Quen 1021; 1021; 31F (
679,						1.0		_		Quenci Mater Mater Mater Alr Co 1 ench;
181	Į			اد				ا ح		Her Goo
loys:				읡	0.9					(1172X), Nater Quench, 930F (772K), 24 Hr, Air Cool (5.25K), 1 Hr, Mater Quench; 1100F (867K), 2 Hr, Air Cool (1283K), 1 Hr, Mater Quench; 1100F (867K), 8 Hr, Air Cool (1242K), 1 Hr, Mater Quench; Aged 1100F (867K), 8 Hr, Air Gool (135K), 1 Hr, Mater Quench; Aged (772K), 24 Hr, Air Cool (973K), Air Cool (122K), Air Cool; 931F (773K), 24 Hr (1273K), Air Cool; 931F (773K), 24 Hr
a A1		Form		귀	2.3	7.7	5.0 5.06	2.25N		(1172) (1283) (1283) (1242) (1198) (1223) (1223) (1273)
TITANIUM, Near a Alloys: IMI 679, IWI 685, 8A1-IMO-IV, 6A1-2Sn-4Zr-2Mo (Sheet 2 of 2)			×	-41		•••	•		PRENT	1650F 1803F 1850F 1775F 1695F 1291F 1921F 1831F
KIUM,			COMPOSITION		~ ب		O 111	tı.	HEAT TREATHENT	22. 188 24. 178 25. 188 26. 188
TITA			COMPC		-, ш	٠,	,	_	HEAT	14 to 4 to 16 to 10

TITAMIUM: 3-8 Atloys: INI 550, INI 551, 6A1-2No (Sheet 1 of 2)

Table 36

是是是是一种的子里是是有一种的子里,是是是是是一种,他们是是一种,他们是是一种,他们也是是一种,他们是是一种的子里,他们是是一种的子里,他们也是一种的子里,他们

		. :									
	Compo-			Yield	Typical	/K _{IC} \		Sp	Specimen		
Form	Heat Treat-	lest Orienta- tion	ارظام، عام،	Strength KSI (MV/m²)	KSIVIn (NN/m - 2)	$2.5\left(\frac{1}{\sigma_{yS}}\right)$ in (mm)	Type	Thickness in (mm)	Width in (mm)	Cruck Length in (mm)	Ref
INI 550 Plate: 0.63 in (16 rm) Thick	Λ,1	T-L	70 (294)	160(1103)	74(81)	0,535(13,6)	Bend	0.5(12.7)	1.5(38.1)	;	98
	A,2	1-1	70(294)	177 (1220)	49 (54)	0.192(4.9)	Bend	0.5(12.7)	1.5(38.1)	;	121
Plate: 1.25 in (31.8 mm) Thick	8,3	L-1	70 (294)	142 (978)	77(85)	0,735(18,7)	(a)	;	;	!	
Plate: 2.13 in (54 mm) Thick	٠, م	lr	70 (294)	170(1174)	(59)65	0.301(7.6)	(B)	;	;	•	
Bar: 3.37 x 0.625 in	5,0	L-1	70 (294)	137 (946)	61 (67)	0,490(12.6)	(a)	;	;	:	49
(85.7 . 15.9 mm)	5'0	T-1.	70 (294)	135(931)	60(65)	0.494(12.5)	(e)	: : :	ŀ	;	64
	9,0	T-1.	70 (294)	135(931)	59(64)	0.494(12.5)	(a)	;	;	; ;	
Bar: 2 x 3.5 in (50.8	E,7	r-S	70 (294)	137 (945)	52(57)	0.360(9.1)	(a)	:	į	ì	Ş
x 88.9 mm)		T-1.	70(294)	156 (1034)	34 (37)	0,128(3,3)	(a)	:	i	;	
		T-S	70 (294)	150(1034)	44 (49)	0,215(5,5)	(a)	i	:	;	
		s-t	70 (234)	121 (834)	49 (54)	0.410(10.4)	(a)	:	1 0 8	1	
		S-T	70 (294)	121 (834)	33(36)	0.186(4.7)	æ	i	ł	:	
Forging: 5 x 1.48 in (127 x 36 am) Thick	E	L-1	70(294)	136(958)	48(53)	0,311(7,9)	(B)	i	;	i	2.
Forging: 5.1 in (130 rm) Square	к,-	S,T-L	70 (294)	136(938)	62(68)	0.520(13.2)	Bend	0.5(12.7)	1 (25.4)	0.54(13.8)	122
	K,	S,T-S,T	70 (294)	136 (938)	48(53)	0,311(7,9)	Bend	0.5(12.7)	1 (25.4)	0.51(13)	
Extrusion	6,7	•	70(294)	137 (945)	53(58)	0.374(9.5)	(a)	1	ł	i	
1:11 551 Jar: 1 in (25.4 nm) Square	11,7	L-T,S	70 (294)	173(1195)	31(34)	0.080(2.0)	(a)	i	:	i	
Extrusion	1,7	L-R	70 (294)	166 (1143)	40 (44)	0,145(3,7)	(a)	ì	:	i	
	6,1	L-R	70 (294)	158(1086)	51 (56)	0,260(6,6)	(a)	:	;	i	
6A1-2Mo Plate: 3 in (76.1 mm) Thick & Forged 2050F (1394K)	3,10	7-1	70 (294)	113(779)	100(110)	1,958(49,7)	Bend	3 (76.1)	6 (152)	3 (76.1)	18
(a) Specimen in Accordance with ASTH Recommendations	TH Recomm	endations		ļ	> >						

Form									
No.			Ref						
Form			Crack Length in (mm)						
Form		c	th nm)						
Form		Specime	Wid in (
Form Item (Cor) (,	hickness in (mm)	•					
Form				-					
Form		/KIC \	$S(\frac{n}{ys})$						
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.									
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.		-	3 NN/m 2					1 Cool	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.		Typica Kr	SIVIĀ (Hr, Air Golden, Air Golden, Air Golden, Air Golden, Er Fr	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.	()							K), 24 Hr, 773K), 773K), 24 H	V
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.	7 77 7	ield	rength ('N/m²)			90		2F (773K), 931F (931F (773K 1 (773K	53
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.		_	St kS:	=	×I			ool; 93: 932F Cool; 11; 93H 11; 93H	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.			.o.k.)		01			Air Couction; Ilr, Air Ilr, Air Air Coc Air Coc Air (773	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.					=1	000000000000000000000000000000000000000		24 III., 864 S. 11. S.	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.	٠		lest rien'a- tion		ပါ	1		(700K), (200k), (2011cd (1172k), (2011cd	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.	100	-o.t.			Si	0.50 0.47 0.54 0.54 0.54 0.53 0.53		800F (Cold F) (Cold F) (Sold F	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.		Sit	T.E		의	0.09 		r Cool; r Cool; r Quenc Cool; J Cool; J31F (7 1650F (Cool; 1	
Form 4.12 4.10 4.12 4.10 4.10 4.10 4.10 4.10 4.10 6.2 4.11 4.11 4.11 4.11 4.11 4.11 4.11 4.	9000				s.	10.00 10.00			
	1				위			000000000000000000000000000000000000000	
COMPOSITION A B B C C C C C C C C C C C C C C C C C	2		Form		퀴	4.0 4.08 4.08 4.02 4.02 4.02 4.03 6.2	=		
CONPOS KEAY			TTION			RLAIMEN			
				сомьо		< = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	KEAT 1		

" IAN UM: " -8 Alloy: IMI 680				Table 37	57						
	Compo-				Typical	/Krc\ ²		ds	Specimen		
an cu	Sition, Heat Treat-	Test Orienta-	Temp	Yield Strength	$\begin{pmatrix} K_{1C} \\ KSI\sqrt{In} \begin{pmatrix} MN_{1m} - \frac{3}{7} \end{pmatrix}$	$\frac{2.5}{\text{in}} \left(\frac{1.5}{\text{ys}} \right)$	Type Type	Thickness in (ma)	Width in (mm)	Crack Length in (mm)	Ref.
Bar: 2 x 1.3 in (50.8	۸,1	L-T	70(294)	179(1234)	29(32)	J °	E E				Ş
	Α,2	;	70(294)	140(965)	(59)65	0.444 (11.3)	3	f f t	;	:	36
Thick Disc	A,3	:	70(294)	143(984)	50(55)	0.306 (7.8)	(a)	;	;	;	
	A,4	;	70(294)	159(1093)	40(44)	0.158 (4.0)	(a)	:	:	;	
	A,5	;	70(294)	163(1123)	32(35)	0.96 (2.4)	(a)	:	:	;	
	A,6	;	70(294)	171(1200)	19(21)	0.29 (0.76)	(a)	i	:	:	
	A,7	i	70(294)	192(1321)	15(16.5)	0.15 (0.39)	(a)	;	:	:	
Forging: 4 x 6.2 in (102 x 158 mm)	A,8	L-1	70(294)	166(1145)	45(49)	0.184(4.7)	Bend	0.50(12.7)	1.5(38.1)	0.35(8.9)	31
Thick Forging:	٨,٦	T-5	70(294)	138(951)	69(76)	0.625(4.7)	Bend	0.5(12.7)	1.0(25.4)	;	60
		T-S	70(294)	150(1034)	54(52)	0.333(8.5)	Bend	0.5(12.7)	1.0(25.4)	:	
(a) Specimen in accordance with ASTM Recommendations	M Recom	nendations									
COMPOSITION											
A1 M0 Sn Fe A 2.25N 4.0N 11.0N 0.2M	M 92.	H N 0.013M									
HLAT TREATMENT											
1. 1471-1501F (1073-1123K); 931F (773K), 2. Forged at 1831F (1273K); 1606F (1148K), 3. Forged at 1596F (1198K); 1606F (1148K), 4. Forged at 1596F (1198K); 1498F (1088K), 5. Forged at 1696F (1198K); 1606F (1148K), 6. Forged at 1606F (1148K); 1606F (1148K), 7. Forged at 1831F (1273K); 1606F (1148K), 8. 1490F (1083K), 1 Hr, Mater Quench; 930F	931F (77 1606F (1 1606F (1 1498F (1) 1498F (1) 1606F (1) 1606F (1)		773K), 24 Hr, Air Cool (1148K), Furnace Cool; 967F (1148K), Furnace Cool; 967F (1088K), Mater Quench; 967F (1148K), Mater Quench; 967F (1148K), Mater Quench; 967F (1148K), Mater Quench; 967F (1148K), Mater Quench; 967F	967F (795K), 24 llr, 807F (795K), 24 llr, 41r (5001	Air Cool						

The state of the s

7A1-4Mo
7A1-2.5Ho,
4A1-3910-1V,
Alloys:
NIUM: a-8

TITANIUM: a-8 Alloys: 4Al-3Mo-1V, 7Al-2,5Mo, 7Al-4Mo	'A1-2,5Mo	, 7A1-4Mo		Table 38						
	Compo-				1ypical	/Krc. 2	Sp	Specimen		
	strion, Heat	lest) reld Strength	AIC 3	2.5()		Kideb	Crack	
Form	Tre it-	Orien a- tion	or cap	kS: ('IN/m²)	KSIVIn (MN/m 2)	-	ın (ma)	111 (mm)	in (mm)	<u>Ref</u>
[1-4A1-3M0-1V	- 4	- 1	70 (294)	155 (1069)	72(78)	0,539(13,7)	0.5 (12.7)	1.5(38.1)	0.3(7.6)	34
Plate: 0.5 in (i.e., ion) inter		· -	70(294)	161(1110)	63(69)	4 Pt 0.382(9.5) Bend	0.5 (12.7)	1.5(38.1)	0.3(7.6)	
12.7 mm Thick	ς · γ	1-1	70 (254)	175 (1207)	66 (72)	4 Pt 0.356(9) Bend	0.5 (12.7)	1.5(38.1)	0.3(7.6)	94
30		(v)	70(294)	146(1007)	49 (53)	0.282(7.2) Bend	0.5 (12.7)	i	1	22
ri-7A1-2,5No Plate: 0.5 in (12.7 mm) Thick	7,3	7-1.	70 (294)	152(1048)	52(57)	0.293(7.4) Bend	0.5 (12.7)	1.5(38.3)	0,35(8.9)	98
	8,3		70 (294)	136 (938)	65(71)	0.571(14.5) hend 4 Pt	0.5 (12.7)	1.5(38.1)	0.35(8.9)	
T:-7A1-4Mo Plate: 0.5 in (12.7 mm) Thick	9,0	Ţ.	70 (294)	145 (1006,	33(36)	0.129(3.3) Bend	0.5 (12.7)	1.5(58.1)	0.3 (7.6)	94
Forging: 0.625 in (15.9 mm) Thick g Processed 2100f (1422k)	°, 1	(a)	70 (294)	155(1069)	41 (45)	0.175(4.4) Bend	0.5 (12.7)	į	:	55
(a) Test orientation is not specified, but loading and crack propagation directions are in a plane where maximum grain flow is approximately radially symmetric.	ed, but itely rad	loading ar lially sym	nd crack propa metric.	gation direction	is are in a plane w	here				
COMPOSITION AL VIO V. I'C	υI	=1	zi							
A 4.5 3.3 1.0 0.10 B 4.4 3.1 1.1 0.08 C 6.9 4.0 - 0.12 D 6.9 3.7 - 0.15 E 6.8 2.4 - 0.04	0.03 0.02 0.023 0.024	0.006	0.11 0.000 0.15 0.007 0.06 0.008							
#	ol; 17251 Nuenched; Lench; 10 Quench; 10 Quench; 13	r (1214K), ; Aged 110 050F (839K 1050F (839 1100F (867	1 Hr, Water Quen OF (867K), 8 Hr, . .), 4 Hr, Air Cool (K), 4 Hr, Air Coo (K), 8 Hr, Air Coo	<pre>IIr, Water Quench; 1050F (83 (867K), 8 IIr, Air Gooled 4 Hr, Air Gool 4 Hr, Air Gool 8 IIr, Air Cool</pre>	<pre>Hr, Water Quench; 1050F (839K), 8 Hr, Air Cool (867K), 8 Hr, Air Cooled 4 Hr, Air Cool 4 Hr, Air Cool 8 Hr, Air Cool</pre>	76				
6. Mill Annealed 7. 1800F (1255K), 0.5 Hr, Water Quench; 1100F (867K), 8 Hr, Air Cool 8. Mill Annealed; Hot Rolled 50* Reduction at 1750F (1228K)	r Quench	; 1100F (8 tion at 17	167K), 8 Hr, A	ir Cool	r F					

TITANIUM, a-8 Alloy: 6Al-4V (Sheet 1 of 2)

Table 39

9 = 63 33 22 34 Ref. 20 7 2.0 (50.8) 6.2 (15.8) 1.8 (4.6) 1.0 (25.4) 2.0 (50.8) 1.0 (25.4) (12.7)(9.4.6) Bend 0.781(19.8) 1.5 (38.1) 0.3 (7.6) 0.9 (22.9) 1.8 (45.8) 0.45 (11.4) (22.9) 1.8 (45.8) 0.45 (11.4) Bend 0.55 (14) 1.02 (26) 0.55 (14) Bend 1.0 (25.4) 1.0 (25.4) 0.267(6.8) Bend 1.0 (25.4) 1.0 (25.4) 0.208(5.3) Bend 1.0 (25.4) 1.0 (25.4) 0.26 (6.6) 1.0 (25.4) 1.0 (25.4) 0.303(7.7) Bend 1.0 (25.4) 1.0 (25.4) 0.290(7.4) Rend 1.0 (25.4) 1.0 (25.4) 0.3 (7.6) Bend 1.0 (25.4) 1.0 (25.4) 0.3 (7.6) Crack Length in (mm) i 2.0 (50.8) 2.25(57.2) 0.5 2.0 (50.8) 6.2 (15.8) 1.8 0.5 (12.7) 1.0 (25.4) 0.5 (12.7) 1.5 (38.1) Width in (mm) Specimen (12.7) 0.5 (12.7) Thickness in (mm) 6.0 0.5 Bend Bend Bend Bend Bend Bend 0.235(6.0) Bend Bend ¥0F ¥01 <u>5</u> (a) ઉ ag(0.429 (10.9) 0.942(23.9) 0.345(8.8) 0.457(11.6) 0.422(10.7) 0.413(10.5) 0.837(21.3) 0.350 (8.9) 0.246(5.2) 0.56 (14.2) 0.769(19.5) 0.063(1.6) 0.225(5.7) 0.224(5.7) 0.792(20.1) 0.161(4.1) 0.263(6.7) 0.240(6.1) 2.5 (KIC) in (m.) -3) 71,78) 58 (<3) 55(60) \$1(89) 68 (75) 61 (66) 55 (60) 78(86) 70(77) 60(65) 16(50) 45 (49) 36 (39) 54(59) 75(82) 42(46) 46(50) 47(51) 48(52) 53(58) lypical 16(50) $KSI (MN/m^2)$ Yield Strength 10(966) 128(883) 117(1011) 148(1034) 146(1007) 180(1034) 150(1034) 148 (1020) 27(875) 59(1097) 150(1034) 227(1565) 140(968) 148(1020) 133(916) (48(1020) 177(1220) 173(1193) (85(1276) : : 75(214) 70(294) 70(294) 70(294) Temp *F (*K) 50(339) 75 (297) 70(294) 70(294) 75(297) 70(294) 75(297) 75(297) 75(297) 75 (297) -50(228) 50(228) -100(200) 75 (297) -321(78) 75(297) -100(200)Test Orienta--1 S-1 T-S 3 L-T 7 : T 1: <u>r-</u>1 3 1-1 : : -1 : ፤ -1 <u>-1</u> 1-1 Compo-sition, Heat Treat-8, 3,5 6,2 E, 3 9,6 ±,7 2,5 H, C, A.1 0.625 in (15.9 mm) Thick B Processed 2100F (1422K) Plate: 1.0 in (25.4 mm) Thickness (r Processed) Plate: 0.75 in (19.1 mm) Nominal Thickness Forging: 3.0 in (76.1 rm) Thick 564 Plate: 0.5 in (12.7 mm) Thick Handforging: 1.0 in (25.4 mm) Thick Plate: 0.5 in (12.7 mm) Thick (, Processed) α+β Processed 1750F (1228K) 2 in (50.8 mm) Dia 2.26 x 1.2 in (57.5 x 30.5 mm) Form Forging: Bar: Bar:

(Sheet 2 of 2) TITANIUM, a-B Alloy: 6A1-4V

Table 39 (Cont.)

	Compo- sition,	Compo- sition,		Nield	Typical Krc	/K1C \2		S	Specimen		
	Heat Treat-	Fest Orient a-	í í	Strength	(8)	2.5(0/ys)		The obsess	⊢	Crack	
Form	ment	tion	~ !	KS1 (91N/m ²)	KSIVIn (MN/m 2)	in (mm) Type in (mm)	Type	in (mm)	n (mm)	in (mm)	Ref
Plate: 3 in (76.1 mm) Thick	к , 9	1-1	70 (294)	122(841)	101(111)	1.717(43.5)	Bend	3.0 (76.1)	1.717(43,5) Bend 3.0 (76,1) 6.0(152,2) 3.0 (76,1)	3.0 (76.1)	18
	К, 10	7-1	70 (294)	113(779)	100(110)	1,958(49,7)	Bend	3.0 (76.1)	1.958(49.7) Bend 3.0 (76.1) 6.0(152.2) 3.0 (76.1)	3.0 (76.1)	
Extrusion: 8.75 in (222 mm) OD 3 in (76.2) Wall Extruded at 1750F (1228K)	L, 11	C-R	70 (294)	138 (952)	58 (64)	0.442(11.2) CT		0.75(19.1)	1,5(38,1)	0,75(19.1) 1.5(38.1) 0.75(19.1) 117	117

<u>e</u> @

Specinen in accordance with ASTI Recommendations
Test orientation is not specified but loading and crack propagation directions are in a plane where maximum grain flow approxinately radially symmetric.

COMPOSITION

=1			0.006	0,008	0,003	•	0,004	0.001	0.002	•		0.004
×1			0.022	0.013	0.018				0.007		0,008	0.009
01				0.16	0.15		0.17		•		0.07	0.13
Si					•		•	•	0.16	•		
ပါ	0.020	3.026		0.024	0.03	0,025	0,023			0.131	0,023	0.02
먎	0.15	0.15	0.16	0.13	0.17	60.0	0.13	0.07	7.0	0.3N	0.5	0,20
>1	7	÷.3	3,78	4.13	3.9	7.7	4:1	3,91	4.24	4.0		4.2
됭	6.3	6,3	5.83	6.1	6.4	6.3	6.3	6.18	6.54	6.13	0.9	6.3
	٠.	æ	ບ	۵	<u>ئ</u>	ı.	9	=	-	٠,	×	٠,

HEAT TREATMENT

1. 1700F (1200K) Air Cool; Age 1000F (811K), 4 Hr
2. 1750F (1228K) 1 Hr, Air Cool; Age 1000F (811K), 4 Hr
3. 1850F (1238K) 30 Hin, Nater Quenched, Aged 1250F (950K) 4 Hr
4. 1725F (1214K) 1 Hr, E. ter Quenched; Aged 1050F (839k) 4 Hr, Air Cool
5. 1725F (1214K) 1 Hr, er Quenched; Aged 1000F (811K) 4 Hr, Air Cool
6. Solution Treated and Aged
7. 1741F (1223K), 1 Hr, Air Cool; 1246F (948K), 1 Hr, Air Cool
8. 1291F (973K), Air Co
9. 1750F (1228K), 3 Hr, Mater Quench; Age 1100F (867K), 4 Hr, Air Cool
10. 1700F (1220K), 3 Hr, Mater Quench; 1000F (811K), 4 Hr, Mater Quench
11. 1750F (1228K), 3 Hr, Mater Quench; 1000F (811K), 4 Hr, Air Cool

Table 40

	Compo-			Yield	Typical	/K1C \2	S	Specimen		
Form	Heat Treat-	Test Orien a-	1,5m; 6,6 (X)	Strength KSI (HN/m²)	$\left(\frac{1}{\text{KSIVIn}}\left(\frac{3}{\text{MN/m}}\right)\right)$	$\begin{array}{c c} 2.5\left(\frac{1}{\sigma_{yS}}\right) & & \\ & \text{in (mm)} & \text{1ypc} \end{array}$	Thickness 1n (mm)	Width in (mm)	Cruck Length in (mm)	Ref
Plate: 1.0 in (25.4 mm) Thick	A, 1	£-7	75 (297)	186 (1283)	33(36)	0.079(2.0)	7	5.0 (12.7) 1.6 (40.6)	1.6 (40.6)	22
	Λ,2	L-1	75 (297)	167(1151)	(65)	0,323(8,2) SEM	1.0 (12.7)	5.0 (12.7) 1.6 (40.6)	1.6 (40.6)	
Plate: 1,0 in (25,4 mm) Thick	8,3	L-T	75 (297)	179(1234)	30(33)	0.070(1.8) Bend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0,200(5,1)	25
ברז הנשקפ	B,4	L-1	75 (297)	171 (1179)	34 (37)	0,099(2,5) Hend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	
	5,4	r-s	75 (297)	:	38 (42)	Bend	0,250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	
	B,4	1-1	-321(77)	258(1779)	23(25)	0,020(0,5) Bend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	
	3,4	1-5	-321(77)	259(1786)	25 (27)	0.023(0.6) Bend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	
Bar: 4.5 in (114.3 mm) Dia.	6,5	D-1	75 (297)	184(1269)	31 (34)	0.070(1.8) Bend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	
Commercial Diane	5,5	1-C	-321(77)	270(1862)	23(25)	0.018(0.5) Rend	0.250(12.7)	0.500(12.7) 0.200(5.1)	0.200(5.1)	 -
Extrusion: 8.75 in (222 mm) OU	11,11	C-P	70 (294)	143(986)	(92)69	0.582(14.8) CT	0.75 (19.1)	1,5 (38,1)	(38.1) 0.75 (19.1) 117	117
Extruded at 1675F (1186K)	1,12	చ-	70(294)	. (0121)061	32 (35)	0.071(1.8) CT	0.75 (19.1)	1.5 (38.1)	(38.1) 0.75 (19.1)	
Forging: 0.625 in (15.8 mm) Thick 8 Processed 2100F (1422K)	C,3	(a)	75 (297)	170 (1172)	38(41)	0.125(3.2) Bend	0.500(12.7)	;	;	22
Forging: 4.5 x 4.5 in (114.3 x 114.3 mm) Vacuum Arc Renelt	5,0	7	75 (297)	149 (1027)	(65)	0,405(10,3) NTC	0.500(12.7)	3.0 (76.2) 1.0	1.0 (25.4)	56
Forging: 4.5 x 4.5 in (114.3 x	5,0	L-ST	-110(194)	181 (1248)	56(61)	0.239(6.1) SEN	0.250(6.4)	1.0 (25.4)	(25.4) 0.500(12.7)	91
Remeit		ST-1.	-110(194)	184(1269)	50(55)	0,180(4,6) SEN	0,250(6,4)	1.0 (25.4)	(25.4) 0.500(12.7)	
Plate: 1.5 in (38.1 mm) Thick	9,0	r-s	-110(194)	195 (1344)	41 (45)	0.110(2.8) SEN	0,250(6,4)	1.0 (25.4)	(25,4) 0,500(12,7)	
		L-1	-110(194)	195 (1344)	32 (35)	0.068(1.7) SEN	0.250(6.4)	1.0 (25.4)	(25.4) 0.500(12.7)	
		TS-TS	-110(194)	195 (1344)	25 (27)	0,043(1,1) CT	0.500(12.7)	1,0 (25,4)	(25.4) 0.50v(12.7)	
Plate: 0.5 in (12,7 mm) Thick	9 .	1-1	-110(194)	210(1448)	33(36)	0,063(1,6) SEN	0.250(6.4)	1.0 (25.4)	(25.4) 0.500(12.7)	
		7.	-110(184)	208(1434)	30 (33)	0,053(1,3) SEN	0.250(6.4)	1,0 (25,4)	(25,4) 0.500(12,7)	
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(Sheet
6A1-6V-2Sn
Alloy:
2 -B
FITANIUM,

TITANÍUM, a-B	Alloy:	6A1-6V-2Sn	(Shaet 2 of	£ 2)		Table	Table 40 (Cont.)							
-			Compo-			Yield	Typical		/K1C \2		Sp	Specimen		
	Forts		Heat Treat- ment	Orichia- tion	Ton, 9F OK)	Strength - KS1 (*!X/m²)	KSI√ī	3)	$2.5\left(\frac{\sigma}{\sigma_{yS}}\right)$ in (mm) T ₁	Type i	Thickness in (mm)	Nidth ın (mm)	Crack Length in (mm)	Ref
Handforging:		1.0 in (22 mm) Thick	F,7	L-T	75 (297)	180(1241)	1) 29 (32)	0	0.065(1.7) Berg	ì	0.55 (14)	1.02 (26)	0.55 (14)	23
				T-L	75 (297)	186 (1282)	2) 26(28)	0	0.049(1.2) Bend		0 (25.4)	1.0 (25.4) 2.0 (50.8) 1.0 (25.4)	1.0 (25.4)	··
8 Forged: 4	4.92 in (125 rm) Dia	rum) Dia	8,3	r-c	70 (294)	139 (958)	(9)(09)	0	0,466(11.8) (b	(g)	;	i	# 5 6	53
			643	L-T	70 (294)	178(1727)	7) 32(35)	C	0.08 (2.1) (a)	2	į	ł	• •	
·····			01,3	1-1	70 (294)	194(1338)	8) 27 (30)	0	0.056(1.4) (a)	<u>.</u>	:	i	į	
•			F. 9 -	1-S	70 (294)	163(1124)	(1) (1/51)	0	0,200(S.1) Cend	and 0.5	5 (12.7) 0.5	0.5 (12.7) 1.0	1.0 (25.4)	69
(a) Test or where m	ientation i aximum grai n in accord	Test orientation is not specified but the loading where maximum grain flow is approximately radial! Specimen in accordance with ASTM Recommendations	fied but t pproximate STM Recomm	>	and crack p symmetric.	ropagation o	and crack propagation directions are in a plane sympetric.	nlane	-					
COMPOSIFION														
	\ \ >1	띪	<u>نا</u>	3l 2l	cl	2.1 221	ri							
<=	5,5	5.5 2.0	0.024 0	0.69 0.73	90.08	0.010 0.003								···
: U:														
<u>-</u>	5.5	4 4 2 0.	0.025 0	0.53 -										
ш U					٠.		154 - 16 -							
= -		5.5 2.0 5.9 2.0	0.02 0	0.81 0.78 0.99 0.97		0.015 0.005	15 - 04 0.02							
HEAF FREATHEN	Z.													·
· ·	F (1117K), F (1158K), F (1144K), F (1172K), F (1117K),	1 Hr, Water heed; 1 Hr, Water theed; 1 Hr, Water Quenched; 1 Hr, Water Quenched; 1 Hr, Water Quenched; 1 Hr, Water Quenched;	Nater "ed; Aged Nater rehed; Aged Nater Quenched; Aged Nater Quenched; Aged Nater Quenched; Aged	1 Hr, Water "ed; Aged 900H (756K), 4 Hr, Water theed; Aged 1200F (829K), 1 Hr, Water Quenched; Aged 1050F (839K), 1 Hr, Water Quenched; Aged 11251 (881K), 1 Hr, Water Quenched; Aged 1050F (839K), 1/4 Hr, Water Quenched; Aged 1050F (839K),	(922K), 4 H (922K), 2 1 (839K), 4 1 (839K), 4 1 (839K), 1 1	1550f (1117K), I Hr, Nater "ed; Aged 900f (756K), 4 Hr, Air Cool 1605F (1158K), 1 Hr, Nater rehed; Aged 1200f (922K), 2 Hr, Air Cool 1600F (1144K), 1 Hr, Nater Quenched; Aged 1050F (839K), 4 Hr, Air Cool 1650F (1172K), 1 Hr, Nater Quenched; Aged 1125f (881k), 4 Hr, Air Cool 1650F (1172K), 1 Hr, Nater Quenched; Aged 1050F (839K), 1 Hr, Air Cool 1550F (1117K), 1/4 Hr, Nater Quenched; Aged 1050F (839K), 1 Hr, Air Cool	100							
7. SOLUCY 8. 1400F 9. 1561F	(1033K), (1123K), (1123K),	Solution America and Aged 1400F (1033K), Air Cooled 1501F (1123K), I Hr, Nater Quench;	Quench;	967F (793K),	4 Hr, Air Cool	[00]								
	(1144K), (1144K), (1144K),	1 Hr, Mater Quench; 3 Hr, Water Quench; 3 Hr, Water Quench;	Mater Quench; 19 Water Quench; 1 Water Quench; 19		4 HF, AIF COOI , 6 HF, AIF COOI , 1 HF, AIF COOI	Cool Cool Cool								
							59<							

Table 41 TITANIUM, a-8 Alloys: 6A1-6V-4Zr-4No, 6A1-2Sn-4Zr-6Mo and 6A1-2Sn-2Zr-2Mo-2Cr (Sheet 1 of 2)

	-ompo-			Yield	Typical Kr	/KIC }		lç	Specimen		
Form	Heat Treat- ment	Test Ortenta- tion	Lup (F)	Strength KSI ('IN/m²)	$\left(\frac{3}{\text{KSIVII}}\left(\frac{3}{\text{MN/m}}\right)\right)$	$\frac{2.5(\sigma_{ys})}{\text{in (run)}}$	Type	Thickness in (mm)	พյdth in (ฅ๓)	Crack Length	Ref
6A1-61-12r-480 ble Forging: 3,5 in (88,9 rm)	λ,1	C-R	70 (294)	157 (1082)	40 (44)	0.162(4.1)	Bend	0.5(12.7)	1.5(38.1)	0.35(8.9)	96
Inick, B Forged 1750F (1228k)		S-3	70 (294)	156 (1075)	46 (50)	0.217(5.5)	Bend	0.5(12.7)	1,5(38,1)	0.35(8.9)	
4+5 FORGCA 15/5F (1130K)	۸,1	C-R	70(294)	170(1172)	51 (54.)	0.225(5.7)	Bend	0.5(12.7)	1.5(38.1)	0,35(8.9)	
		c-s	70 (294)	168(1158)	62(68)	0.340(8.6)	Bend St	0.5(12.7)	1,5(38.1)	0,35(8,9)	
Forging: 4.25 x 6 in (108 x	۸,1	T1	70 (294)	160(1103)	49(54)	0.234(5.9)	Bend	0.5(12.7)	1,5(38,1)	0.35(8.9)	
1575 1130K) ava rorgen 1575 (1130K)		15	70 (294)	153(1055)	41(45)	0,180(4,6)	Berg.	0.5(12.7)	1.5(38.1)	0.35(8.9)	
Forging: 4 x 6.2 in (102 x 158 nm), α+β Forged 1540F (1.12K)	6.	r-T	70 (294)	151(1041)	45 (49)	0.222(5.6)	Bend 4 Pt	0.5(12.7)	1.5(38.1)	0,35(8.9)	31
6A1-25n-42r-680 Forging: 1.5 in (38.1 mm) Square 8 Forgad 1800f (1255k), hater Quench	د'،	•	70 (294)	*180(1241)	46 (50)	I	:	ŀ	i	;	100
Forging: ? in (50.8 mm) Thick 8 forged 1800F (1255k), hater Quinch	6,4		70 (294)	*168(1158)	(99)(09	}	;	;	;	1	
Forging: 3.5 in (88.9 mm) Thick g Forged	ະ 'ວ	ر- ₂	70 (294)	169(1165)	22(24)	6.042(1.1)	Bend 4 Pt	0.5(12.7)	1,5(38,1)	0.35(8.9)	96
Forging: 4.3 x 6 in (108 x :52 mm)	C, 3	1-1	<u>.</u>	158(1089)	41(45)	0.168(4.3)	Bend	0.5(12.7)	1.5(38.1)	0.35(8.9)	31
(1172K) Max	C,2	[]	70 (294)	174(1200)	25 (27)	0.052(1.3)	Bend 4 Pt	0.5(12.7)	1.5(38.1)	0.35(8.9)	
6A1-2Sn-2Zr-2No-2Cr Bar: 4 in (101.6 mm) Dia	5 * 0	÷	70 (294)	160(1103)	62(68)	0,376(9,6)	CT.	1.0(25.4)	2.0(50.8)	1.0(25.9)	101
		R-L	70 (294)	161131)	(95)15	0.242(6.1)	๖	1.0(25.4)	2.0(50.8)	1.0(25.9)	
	9'0	L-R	70 (294)	161(1110,	58(64)	0.324(8.2)	CT	1.0(25.4)	2.0(50.8)	1.0(25.9)	-
		R-1.	70 (294)	169(1165)	45 (49)	0.177(4.5)	5	1,0(25.4)	2.0(50.8)	1.0(25.9)	
forging: 1 in (25.4 mm) Thick,	D,7	•	70 (294)	158(1089)	74(81)	0,548(13,9)	5	1.0(25.4)	2.0(50.8)	1,0(25,9)	
*Ultimate Strength Values	D, 7	ŧ	72(294)	160(1103)	(SOM(S))	0.340(8.6)	b	1,0(25,4)	2.0(50.8)	1.0(25.9)	

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(Cont.
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Table
7)
2 of

	Г	 				 	
_	Ref						
	Crack Length						
Specimen	Width in (mm)						
\$	Thickness in (mm)						
	1ype						
/ ^K 1C \ ²	$\frac{2.5(\frac{1}{\sigma_{yS}})}{\text{in (mm)}}$						
Typical K1C	-3 N/m -3		0.12 0.012 - 0.15M 0.02M - 0.25N				
Yield	<i>= 4</i> ∫		Gu II 0 0.012 0.014 0.12 - 0.15M 0.15M				61 <
	, 1 H. (A) 1.81	-	6 15 15 Cu		r, Air Cool; 950f (873K), 8 Hr, Air Cool r, Katel Quench; 1100f (867K), 8 Hr, Air Cool r, Air Cool; 1100f (867K), 8 Hr, Air Cool r, Mic Cool; 1100f (867K), 8 Hr, Air Cool r, Kuter Quench; 1000f (81K), 4 Hr, Air Cool r, Oil Quench; 1000f (811K), 4 Hr, Air Cool r, Air Cool; 1000f (811K), 4 Hr, Air Cool		
	165 9,14,11,12 1,1011		하		373K), 8 Hr, 90F (867K), (867K), 8 Hs (867K), 8 Hs (867K), 8 Hs (811K), 4 Hs (811K), 4 Hs (811K), 4 Hr		
Compo-	12. et - m. et		4.20 4.00 6.00 2.08 2.08		ool; 950F (Quench; 119 201; 1100F 201; 1100F Quench; 100 Lench; 1000f 201; 1000F		
			2, 0, 4 4, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,		1 Hr, Nate: 1 Hr, Nate: 1 Hr, Air C. 1 Hr, Air C. 1 Hr, Niccr 1 Hr, Oil Q. 1 Hr, Oil Q.		
	Form		A1 V 6.18 5.74 6.0N 6.0N 6.0N -		(1103K), 4 (1144K), 1 (1144K), 1 (1186K), 1 (1225K), 1 (1225K), 1		
		COMPOSITIAN	<a> 2 = 2 = 2 = 2 = 2 = 2 = 2 = 2 = 2 = 2	HEAF IREAIMENT	1, 15.25 2, 1600F 3, 1600F 4, 1675F 5, 1745F 6, 1745F 7, 1745F		

(HANIUM, B Alloys: 13V-11Cr-3A, 846-8V-2Fe-3Al, 11.5Mo-62r-4.5Sn, 3Al-8V-6Cr-4Zr-4MO (Sheet 1 of 2) Table 4?

in the property of the total of the property o										
	-odua)	 ·		Medd	lypical K	/KIC 1	S	Specimen		
Form			01 01.1	Stringth	"IC "3)	$\frac{2.5\left(\frac{1}{\sqrt{y}}\right)}{\sin (mm)}$	Thickness Type in (mm)	Kidth in (mm)	Crack Length in (Em)	Ref
13V-11CR-3A(B12AVCA) Bar: I in (35.7 mm) Dia	۸,1	IS-1	300 (422)	159(1096)	39 (43)	0.150(3.8)	VR Do=,505(12,8) Di=,375(9,5)	Di=.375(9.5)		28
-	۸,1	18-1	70 (294)	181 (1548)	32(35)	0,078(2,0)	NR Dom. 505(12.8) Dim. 375(9.5)	Di=,375(9.5)		
		18-7	-45 (230)	200 (1379)	28(31)	049(1.2)	AR Dor, 505(12,8) Dis, 375(9,5)	01=,375(9.5)		
Forgin 9.625 in (15.9 mm) Thick c.8 Processed: 1675F (1186K)	8,2	(a)	70 (294)	178(1227)	43(47)	0,146(3,7)	Bend 0.500(12.7)	į	!	23
Forging: 0.625 in (15.9 nm) lbick 8 Processed: 2109f (1422K)	5,8	(a)	70 (294)	176(1213)	41 (45)	9,136(3,5)	Bend 0,500(12.7)	}	;	····
Forging: 4 in (102 mm) flick	٨,3	<u>:</u>	70 (294)	166(1145)	24(26)	0.052(1.3)	Bend 0.500(12.7)	1.5	(38.1) 0.35 (8.9)	31
8Mo-85-21 c-5A4 Plate: 0.5 in (12.7 nm) Thick Forged at 1950F (1539k)	ę.	-	70 (294,	195 (1345)	45 (49)	0,133(3,4)	SEN375(9.5)	1,128(28.6) 0,375(9.5)	(3.6) 375	93
Flate: 2 in (50,8 mm) Thick Forged at 1550F (1339E)	D,4	<u>-</u>	70(294)	200(1379)	49(54)	0,150(5.8)	SIN 0.375(9.5)	1,125(28.6) 0,375(9.5)	3,375 (9.5)	
Closed bre Forging: 0.5 in	8,1	1-1	70 (294)	181(1248)	38(41)	0.110(2.8)	Bend 0.500(12.7)	1.5	(58.1) 0.300(7.6)	65
(12.7 mm) lines, 2.5 in (6 5 mm) lines.		Ξ	70 (294)	178(1227)	41 (45)	0,133(5,1)	Bend 2.5 (63.5)	1.5	(38.1) 0.300(7.6)	
Forged Bar: 3 in 76.2 im) Square	S	1-1	70 (294)	165(1138)	52(1,7)	0.248(6.3)	(b) bcad	;	:	30
ferging: 4 to (102 am.) Huck	1,5	[-]	70 (294)	176(1213)	63(59)	0.317(8.1)	Bend 0.5 (12.7)	1.3	(38.1) 0.35 (8.9)	31
Extrusion: Cylinder 8,75 in (222 mm) 00 5 in (76.2 mm) Wall, Extruded at 1475F (1075k)	9,6	S. S.	70 (294)	179 (1254)	51(56)	0,203(5,2)	er 0.75 (19.1)		(38.1) (0.75 (19.1)	7.1
11.540-62r-1.55n (s111) Place: 0.5 in (12,7 mm) thick	= '	1-1	70 (294)	174(1200)	61(6/)	0,305(7.	Rend 0.5 (12.7)	1.5 (58.1)	i	32
Plate: 0.64 in (16.3 nn) Thick	8,1		70 (294)	166 (1145)	51(56)	0.236(5.9)	Bend 0.525(13.3)	1.5 (38.1)	;	'2
62<	6.1	1	70 (294)	150(1034)	(12)	0.469(11.3)	Berd 0,525(15.5.	1.5 (38.1)	:	
	1,10	•	70 (294)	148(1020)	71(78)	0.573:14.6) Rend	Rend 0.525(15.3)	1.5 (58.1)		

	Compo-	Compo-		Pleix	; ⁵	Viold	Typical	/K1r	2	8	Specinen		
		fleat Treat	Test Orienta-	- -		Strength	, IC	2.5		Thickness	Kidth	Crack	
Form		тепе	tion	°r '°K)	_	KSI ("t\/m²)	KSIVIn (MN/m ²)	in (mm)	Type	in (man)	ın (man)	in (mm)	Ref
Forging: 4 in (102 mm) Thick	m) Thick	1,11	T1	70 (294)	182(182(1255)	61(67)	0.280(7.1)	Bend	0.5 (12.7)	1.5 (38.1)	0.15 (8.9)	31
Extrusion: 0.97 in (24.6 mm) Dia	24.6 mm) Dia	K, 12	L-R	70 (294)	233(233(1606)	25(27)	0.027(0.7)	Bend	0.394(1)	0.394(1)	į	113
Extrusion: 0.9 in (22.9 mm) Dia	2.9 man) Día	K, 14	L-R	70 (294)	186 (186 (1282)	41(45)	0.121(3.1)	Bend	0.394(1)	0.394(1)	1	118
		K,15	L-R	70 (294)	167 (167 (1151)	54(59)	0.261(6.6)	Bend	0.394(1)	0.394(1)	i i	
3A1-8V-6Cr-4Zr-4No (BC) Forging: 4 in (102 am) Thick	SC) m) Thick	3,13	T-7	70 (294)	158(158(1089)	53(58)	0,281(7,1)	Bend	0.5 (12.7)	1.5 (38.1)	0.35 (8.9)	31
Billet: 6 in (152 mm) Square) Square	3,13	L-T,SF	70 (294)	167(167 (1151)	59(65)	0.312(7.9)	Bend	0.75(19.1)	1.5 (38.1)	0.78 (19.8)	611
COMPOSITION													*****
>1	Cr A1 F	υI	위	us zz	zi	CI	피						
A 13N b 13.5 C 7.08	11N 3N - 10.5 3.1 0.16 - 2.97 2.16	0.05M 16 0.17 16 -	8.04	111	6,019	- 0.112	1 1 1						
8,09		2,19 -	8.15		0.020		, 0						
	^				0.088	0.148	0.010.0 0.010.0						
	2.3 1.8	8 0.022	8.2	4 12 4 60	0.018	o. lo	6,037						
			11.5		· ·		ı •						
NS ·	6N 3.1 -	- 11 244nnn	4N 20.05	48 5.86 4.48	- 80 - 80 - 80 - 80	1515000	55000						
·							uddee						
REATMENT 1425F 1350F 1335F 1500F 1475F	(1047K), 0.25 Hr; 900F (750K), 72 Hr (1006K), 2 Hr, Air Cool; 1450F (1051K), 0.5 Hr, Nater Quent (997K), 1 Hr, Air Cool; 1459F (1061K), 0.5 Hr, Air Cool; 90 (1089K), 10 min. Air Cool; 200F (756K), 16 Hr, Air Cool (1075K), 1 Hr, Nater Quench; 1000F (211K), 8 Hr, Air Cool	F (75eK), 51; 1450F 1; 1459F Cool; 200F Quench; 10	72 Hr (1051K), (1061K), c (756K), 100F (21K)	0,5 Hr, Nater Quench; 906F (756K) 0,9 Hr, Air Cool; 900F (756K), 15 Hr, Air Cool	er Quench; Cool; 900k Cool	900F (75dK),	906F (756K), 20 Hr, Air Conl (756K), 15 Hr, Air Cool	lo.					
	. 1.5 Hr. Marcr Mench; 10400F (818), R SF. Air Cool . 13 min, Dolay 15 sec. Marcr Quench; 950F (783K), 8 Hr . 1 Hr. Marcr Church; 400F (754K), 8 Hr	r (dench; 7 15 sec, mench: @	Kater (ne Kater (ne	irch; 950F (Air Cool 783K), 8 1	<u>.</u>							
	(1089X), i Hr, Mater Quonch; 550r (561K) (1144X), i Hr, Mater Quonch, 900P (756K)	wench; 55	OF (561K) OP (756K)), 0.5 Hr, Air Cool), 100 Hr, Air Cool	ir Cool								:-
11. 1325F (992K), 12. Extruded at 1 13. 1500F (1089K)	1343F (992K), 1 Hr. Mater (usnch; 950F (763K), 8 Hr. Air Cool Extruded at 1800F (1555K), Water Quench; Swagged 5% Reduction in Arca; 900F (755K), 8 Hr. 1500F (1988K), 0.25 Hr. Air Cool: 1850F (Arck), 11, Air Cool	Jones 950	F (783K), Ich; Swagg OF (919K)	8 Hr, Air ed 5% Reduc	Cool tion in At	4006 tva.	(755K), 8 lfr.						
	Extruded at 1400F (1033K), Mater Quench; Aged Extruded at 1800F (1255K), Air Cooi; 1400F (1	Water Quer	ich; Aged 1400F (10	900F (756K), 8 Hr 033K), 0.5 Hr. Kat	(756K), 8 Hr, Air (250) 0.5 Mr. Water Quench:	r Gool bench: 900	756K) 8 Hr, Air Gool 0.5 Kr, Mater Owench: 900F (756K), 8 Hr. Air Cool	ir Cool	63~	٧			
			1	. 1									7

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Table 43 ALUMINUM, Copper Alloys: 2014, DTD 5020, HID 66, BS L77, BS L93, GB-26S (Sheet 1 of 2)

Form Static Form Stringth March Ma			Compo-	<u> </u>			(Typical	, , , ,		S	Specimon	,	``;
Planer 1.0 in A. (a) L.T 70(294) 07(462) 24(26) 0.221(6.2) (b) 1.0 (35-4) 2.0 (5.5) 1.0 (35-4) (c) 1.0 (35-4) (c) (c	Temper		sition, Heat Treat-	Test Orienta- tion	Temp °F (°K)	Yield Strength KSI (MV/m ²)	KSI\In (MM m 2)	5	\$	1	#idin is (pm)	Congress (in (ma)	7.4
CES-4 ma) Thick T.L. 70(294) 66(455) 21(23) 0.232; 6.4; (b) 1.0 (35-4) 1.0 (5.8) 1.0 (35-4)	2014 T651	Plate: 1.0 in	A, (a)	L-T	70(294)	67 (462)	24(26)	0.321(8.2)	(a)	1.0 (25.4)		1.0 (25.4)	ζ; .
Plate: 5.0 in		(25.4 mm) Thick		1-1	70(294)	66(455)	21(23)	0.2535 6.47	(<u>P</u>			1.9 (25.4)	
(127 mm) Thick A ₁ (a) T ₂ , 7(294) 58(400) 21(23) 0.528(8.3) (b) 1.0 (25.4) 2.0 (5.1) i.d (55.4) 5.0 (5.1) i.d (5.1) 5.0 (5.1) i.d (5.1) 5.0		Plate: 5.0 in	A, (a)	L-1	70(294)	59(407)	21(23)	0.317(8.1)	(9)			1.7 (25.4)	•
St. 77 (294)		(127 mm) Thick	A, (a)	7-1	70(294)	58(400)	21 (23)	0.328{ 8.3}	<u> </u>			3.0 (25.4)	-
Plate: 1.0 in A, (a) T-L -320(78) 26(28) - (b) 1.02 (75.9) 2.0 (59.4) 1.01(25.6) 2.53. min Thick Plate: 2.5 in (63.4) A.4 T-S 70(294) 65(435) 24(26) 9 (9.2) (b) 3.0 min Thick Strussion: 0.523 in A, (a) L-T 70(294) 64(441) 30(33) 0.549(13.9) SEM 0.512*(7.9) 2.0 (59.4) 1.01(25.9)				S. L	7~(294)	ı	19(21)	•	٠	•	`` ``	• J~	
Sin		Plate: 1.0 in (25.4 mm) Thick	Λ, (a)		-320(78)		26(28)	•	()	1.02 {?3.9]		1.01(25.6)	a Ž
Structure Stru		Plate: 2,5 in (63. 5 mm) Thick	A,4	T-S	70(294)	63(435)	24(26)		ê				92
Extrusion: 1.755 in A, (a) 7-L 70(294) 62(427) 25(27) 0.406 (10.5) SEW 0.312' 7.5' 1.940(15.9) - (44.6 mm) Thick (44.6 mm) Thick (50.4 × 203.2 mm) Thick (50.4 × 203.2 mm) B, 1 7-L 70(294) 65(448) 19(21) 0.214(5.4) Nend 0.750(19.1) 1.5 (38.1) - (50.4 × 203.2 mm) B, 1 7-L 70(294) 65(448) 19(21) 0.214(5.4) Nend 1.50 (38.1) 3.0 (75.2) - (7.1) 70(294) 55(134) 19(21) 0.278(7.1) Ench 1.50 (38.1) 3.0 (75.2) - (7.1) 70(294) 57(39) 19(21) 0.278(7.1) Ench 1.50 (38.1) 3.0 (75.2) - (7.1) 70(294) 57(392) 19(21) 0.278(7.1) Ench 1.50 (38.1) 3.0 (75.2) - (7.1) 70(294) 57(392) 57(3	16510	Extrusion: 0.625 in (15.9 mm) Thick	А, (а)	ר-ז.	70(294)	64(441)	30(33)	0.549(13.9)	SEN	c. 594(15,1)			7
Solution		Extrusion: 1.755 in (44.6 mm) Thick	A, (a)	J-J.	70(294)	62(427)	25(27)	0.406 (10.3)	SEN	0.3121 7.9)	1,940(23.9)	1	-
(50.% x 203.2 mm) B, 1	T652		B, 1	L-1	70(294)	67 (462)	25(27)	3.3:8(8.8)	Bend	0.750('').1)		. "	#
C.1 C.7 70(294) &\$5(134) 34(37) 0.728(18.5) & 6nd 1.50 (38.1) 3.0 (76.2) - C,1 T-L 70(294) \$90(40.) 23(25) 0.280(9.7) Bend 1.50 (38.1) 7.0 (76.2) - C,1 T-L 70(.994) \$7(393) 19(21) 0.278(7.1) Bend 1.50 (38.1) 3.0 (76.2) - Place: 3 in (76.2 ma) D.2 L.T 70(294) 64(442) 26(28) 0.413 (10.5) (b) Thick Thick C.1 T-L 70(294) 64(442) 26(28) 0.414 (10.5) (b) C,2 T-L 70(294) 59(405 24(25) 0.414 (10.5) (b) C,3 T-L 70(294) 59(405 24(25) 0.414 (10.5) (b) C.2 T-L 70(294) 59(405 24(25) 0.414 (10.5) (b)		(50.% x 203.2 mm)	8,1	1-1	70(294)	65(448)	19(21)	0.214(5.4)	Bend	0.750(19.1)		t	
Solution C,1			c.1	ز. ن	70(294)	४३६१३४)	34(37)	0.728(18.5)	pung	1.50 (38.1)		•	
SOZO S. S. S. S. S. S. S. S			۲,1	T-L		\$9(40)	23(25)	0.280(9.7)	pend	1.50 (38.1)		•	_
Place: 3 in (76.2 mm) D.2 L.T 70(294) 64(442) 26(28) D.4;3 (10.5) (b) 1 in (25.4 mm) D.2 T-1. 70(294) 59(405 24(26) 0.414 (10.5) (b) Thick			ແ,	<u>ب</u> رئ	70(394)	\$7 (393)	19(21)	0.278(7.1)	Festi	1.50 (38.1)	-	-	
Plate: 3 in (76,2 ma) D, 3 L.T 70(294) 64(442) 26(28) 0.414 (10.5) (b) 1 in (25.4 ma) D, 2 T-1, 70(294) 59(405 24(25) 0.414 (10.5) (b) Thick	oto s	55											
D, 2 T-1, 70(294) 59(405 24(28) 0.414 (10.51 (b)	ů.	Plate: 3 in (76,2 ma)	۲۲ .	L·1	70(294)	64(443)	26(28)	0.453 (10.5)		:	:	:	72
6 4≤		thick I in (25.4 m;) Thick	2,0	T-1.	70(294)	59(405	24 (26)	0.814 (13.5)		:	1 7 8	; - ;	
						_	64 <						
												-	-

Specimer Thickness in (mm) : i 320 3 3 3 E 9 æ 0.239 (60.7) 0.187 (4.7) 0.287 (7.5, 0.544 (8.7) 0.235 (6.0) 0.333 (8.5) 2..5 (KIE) in (m Table 45 (Cont.) $\left(\frac{3}{2}\right)$ KSIVÎN $\left(\frac{3}{100}\right)$ 17.5(19) 20(22) 21(23) 23(25) 19(21) 28(25) Typical 2 af 2) Yield Strength XȘI (MN/m²) 65(445) 64(440) 63(437) 62(428) 62(425) 62(429) 2014, DEB 5020, HID 66, BS 1.71, aS 195, at Temp *F (*K) 70(2! 1) 70(294) 70(294) 70(294) 70(294) 70(294) Test Orienta-tion -1.-S T-S ÿ. S-L <u>:</u> Composition, Heat Treate, e Ľ,, 0,3 Plate: 1.5 in (38.1 rm) Thick Plato: 0.5 in (12.7 mm) Thick MINISTRA COPPER 1112. Forging: No.rm BSL-93 H1D 66 BSL-77 Tenpor Ğ. ŝ

Ref.

Crark Length in (mm)

Midzh in (me)

73

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3

0.251 (6.4)

19(21)

60(414)

70(294)

S-1.

83

3.8 (93)

(254)

DCB 1.5 (38.1) 10

0.54 (13.6)

19(21)

41(283)

70(294)

<u>-</u>-

3,4

Plate: 2.5 in (65.5 mm) Thick

GB-26S

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Fabrication and Heat Treatment in accordance with Applicable Military, Tederal, NSIM or Aluminum Association Specifications. 3 8

	COMPO	OMPOST LON										HEVE PREABILISE
		3	쓁	ŝį	<u>.</u> 2	됬	គ	اڻ	디	Z	ଣ	1. Solution Heat Treated, Cold horked and Artificially Aged in Accordance with
	•	4. SN	0.5N	.0.	1.0N	1.0%	0.254	O. 1M	0.1M 0.15M -			The special control of the second and Aluminum Standards and Hata.
_	~	1.58	69.0	0.93	0.23	0.73	0.08	0.01 0.04	0.04			11. 12. 12. 12. 12. 12. 12. 12. 12. 12.
_	_	1.31	0.50	0 97	0.24	0.73	0.14	0.01	0.0			CASA MARCH TOOL TOOL TO THE TOOL TOOL TOOL TOOL TOOL TOOL TOOL TOO
_	<u>-</u>	 	0.62N	0.7SN	<u>-</u>	0.8N	٠. بر			N0		4. 34. (7.00), Mitter Quenich Screece 1.3-3-3, Age 340; (444k), 8-12 Hr
_		7. 5.	0.58	0.7X	0.SM	0.8%	o.3	•		ر د د	0.05%	
	:	1.03	0.66	5.81	0.42	0.74	•	•	0.01			

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ALUMINUM	ALUMINUM, Copper Alloy: 2020	2020			Table 44	14						1
		Cogho	-			Typical	/K.c.\ ²		çs	Specimen		
		Bition	Heat Test	Temp	Yield Strength	Arc 3	(2.5 (%) (3/5)		Thickness	Width	Crack Length	
Temper	Form	Fest Fest	tton	<u></u>	KSI (MV/m²;	KSIVín (MN m 2)	in (men)	Type	in (mm)	in (mm)	in (mm)	Ref.
ToS1	Plate: 1.375 in	in A. (a)	1-1	70(294)	76(524)	22 (24)	0.209 (5.3) Bend 1.375(34.9) 3.0 (76.2)	Bend	1.375(34.9)	3.0 (76.2)	;	38
	(34.9 mm) Thick		1-1	70(294)	77(531)	18(21)	0.152 (3.9) Bend 1.375(34.9) 3.0 (76.2)	Bend	1.375(34.9)	3.0 (76.2)	:	
3	(a) that Treatment in Accordance with Applicable Military, ASTM or Aluminum Association	Accordance with A	policable M	Illtary, ASTM	or Aluminum Assoc	ciation						

(a) Heat Treatment in Acco. Specifications.

COMPOSITION

1 .0 N Cd Li 0.23N 1.3N Mn Zn 0.5N 0.25M Cu Mg Si Fe 4.SN 0.03M 0.4M 0.4M

26(28)

21(23)

70(294)

1-1

<u>:</u>

₹, (Ξ)

Plate: 0.5 in (12.7 mm) thick

٨.(٤)

Plate: 1.0 in (25.4 mm) thick

70(294)

1.7

B, (a)

Plate: 1 in (25.4 mm) Thick

2219

70(294) 72(296)

<u>;</u> **₹-**

B, (a)

8,3

Plate: 2.5 in (63.5 mm) Thick

9

1.0 (25.4) 5.0 (127.0) 1.5 (40.0)

0.809(20.5) SLN

33,36)

ŝŢ

1.0 (25.4) 0.500(12.7)

1.9 (25.4) 2.0 (50.8) 0.500(12.7) 1.0(25.4) 0.500(12.7) 1.0(25.4)

1,0(25,4)

Bend

0.480(12.2)

Bend Bend

ij

0.625(15.9) 0.431(10.9)

10(411 27 (23)

> 70(294) 70(294) 70(294) 70:294) 70(294)

32(35)

1.0 (25.4)

Rend

0.131(10.9)

77(7.4)

1,9(25.4)

0.355(9.0) Bend

23 (25)

70(294)

]

~; ;

Plate: 1.0 in (25.4 mm) thick

-100(200)

:

321(78)

<u>;</u>

-423(22)

1-1 1-1 7-1 L-7 7-1

Λ, (a)

B, 2

Plate: 0.5 in (12.7 mm) thick)

5

1.0 (25.4) 1.0 (25.4) (12.7)

0.500(12.7)

33

0.5 0.5

1.0 (25.4) 2.0(50.8) 0.5 (12.7) 1.0(25.4)

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1.0 (25.4) 2.0(50.8)

ê

0.745(18.9) 0.342(8.7) 0.4 (10.3) 0.269(6.8)

36(39) 21(26)

0.523(8.2)

23 (25)

(12.7)

0.5 (12.7) 1.0(25.4)

36

1.25 (31.8) 2.5 (63.5) 1.25 (31.8)

1.131(28.7) Bond

37(40)

1.0 (25.4) 5.0 (127.0) 1.6 (40.6)

SLN

0.743(18.9)

30(33)

1.25 (31.8) 2.5 (63.5) 1.25 (31.8)

1.25 (51.8) 2.5 (63.5) 1.25 (31.8)

Hond

0.982(24.9) 1.036(26.3)

42(44) 47(31)

320(73) -423(21)

Bond

And the second

Ref. 9

Crack Length in (mm)

Width ir (mm)

Thickness in (mm)

Type

 $2.5 \binom{K_{1C}}{\binom{\sigma_{ys}}{ys}}$ in (man)

Table 45

ALANINUM, Copper Alloy: 2021 and 2219 (Sheet 1 of 2)

Yield Strength

Temp °F (*X)

Test Orienta-

Form

[caper

2021 T6

Compo-sition, Heat Treat-ment

70(294)

J-S

ê

0.36" (9.3)

23(25)

Spec tmen

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- \$--- *

[Ref.		7	2			13		26
		Crack Length in (mm)		1.047(26.6) Band 1.40 (35.6) 3.0 (76.2) 1.5 (38.1) 44	1.0 (25.4) 5.0 (127.0) 1.6 (40.6)	1.6 (40.6)	(40.04)	1,375(34.9) 2,75(70.0) 1,375(34.9)	1.375(34.9) 2.75(70.0) 1.375(34.9)	1,375(34.9) 3.0 (76.2) 1.55 (59.4)
	Specimen	Width in (mm)		3.0 (76.2)	5.0 (127.0)	0 2000	1.017(25.8) SEN 1.0 (25.4) 3.0 (12/.0) 1.0 (40.5)) 2.75(70.0)) 2.75(70.0)	3.0 (76.2)
	S	Thickness Type in (see)		1.40 (35.6)	1.0 (25.4)		1.0 (25.4)			
		Š.		Bond	SEN	;	SEN	ê	(<u> </u>
	/K - \2	$\begin{pmatrix} 2.5 \begin{pmatrix} 7.5 \\ o y_3 \end{pmatrix} \\ in \begin{pmatrix} m_m \end{pmatrix}$		1.047(26.6)	1.037(26.4) SEN	,	1.017(25.8)	1.246(31.6) (b)	0.788(20.0) (b)	0.841(21.4) (b)
Cont.)	Typical	K _{1C}	,	33(36)	38(41)		37 (10)	36(39)	32(35)	29(32)
Table 45 (Cont.)		Yield Strength	KSI (my/m)	51(352)	59(407)		28(400)	51(352)	57 (393)	50(345)
r		Temp	(V)	70(294)	70(294)		70(294)	70(294)	70(294)	70(294)
Shoot 2 of		ු දි	tion	:	L-T		1-1	r- r	1-1	7
) 0166	6130	sition, Heat Treat-	ment	æ	B, (a)			8, (2)		B, (a)
1000	MEMINING, Copper Alloy: 2021 and 2419 Concer-		Form	111210		(25.4 mm) Thick		Plate: 1.375 in	(a4.9 mm) tates	
	1,13	ı	Temper	2219	Cor					

(a) Fabrication and Hear Treatment in Accordance with Applicable Military, Federal, or Aluminum Association Specification (b) Specimen in accordance with ASIM Recommendations

COMPOSITION

Ę.	0.03M - 0.03
ᆱ	0.15M 0.11
볘	0.18N 0.18N 0.13
>	0.1N 0.1N 0.08
= 1	0.06N 0.06N 0.95
3	0.1M 0.1M 0.01
휘	0.3N 0.3N 0.25
의	0.38 0.38 0.11
18	0.00 0.28
왥	0.02N 0.02M 0.05
31	6.38 6.08
	< ≈ ∪

HLAL BREATMENT

985F (805K), 2 Hr.
 325F (436K), 24 Hrs.
 990T (806K), Kater Quenched, Prenged 300F (422K), 1 Hr, Stretch 1.05 Maximum, Aged 325f (436K), 16 Hr
 436K), 16 Hr
 Annealed 1850F (1117K) Argon Atmosphere, 8 Hr, Furnace Cool

		tio2	Compo-	1			Typical	, K	L	S	Specimer		
		SHI	sition,	•		Yirld	K _{1C}	2.5(-10)				Crack	
Темрег	Form	Tre	Treat-	Orient 1-	Leng or Jok)	Strength KSI (MV/m²)	$\left(\frac{3}{\text{KSIVIn}}\left(\frac{3}{\text{MN/m}}\right)\right)$	'ss' in (man)	T/pc	Thicknecs in (mm)	Width in (mm)	Length in (mm)	Ref
2024 T851	-	ν'	Λ, (α)	7-t	70 (294)	64 (441)	20(22)	0.244(6.2)	Bend	1.375 (34.9) 3.0		(76.2) 1.51(38.4)	39
	(34.9 mm) Thick			1	-112(193)	69 (476)	22 (24)	0,254(6,5)	Bend	1,375(34,9)	3.0	(76.2) 1.51(38.4)	
				Ī	-320(78)	79 (545)	22 (24)	0.200(5.1)	Bend	1.375 (34.9)	3.0 (76.2)	76.2) 1.51(38.4)	
				٠	70 (294)	66 (455)	24(26)	0,331(8,4)	Bend	1,375(34.9) 3.0		(76.2) 1.51(38.4)	
	::	1.5 in A,	Λ, (n)		70 (294)	66 (455)	33(36)	0,625(15,9)	(į	:	:	37
•	(381 rm) Thick			T-1.	70 (294)	65 (448)	32(55)	0,606(15,4)	(þ	;	;	i	
	Plate: 4.0 in	A.	Λ, (α)	Ξ.	70 (294)	62(427)	32(35)	0,625(15,9)	(b,	0 (25.4) 2.0		(50.8) 1.0 (25.4)	37
	(101.7 mm) Thick			<u>1</u>	70 (294)	61 (420)	25(27)	0.42 (10.5)	a	1.0 (25.4)	2.0	(50.8) 1.0 (25.4)	
	Plate: 2.2 ln			÷.	70 (294)	56 (386)	25(27)	0,498(12.6)	Bend	0.55 (14)	1.02 (26)	0.55(14)	27
	(55.9 mm) Thick			÷	70 (294)	56 (386)	22(24)	0.386(9.8)	Bend	1.0 (25.4)	(25.4) 2.0 (50.8) 1,0 (25.4)	1,0 (25.4)	
	Plate: 3 in	A,	Λ, (α)	T-1	300 (422)	\$5 (379)	27 (29)	0.602(15.3)	b	0.75 (19.0) 1.5		(38.1) 0.75(19.1)	116
	(/6.2 mm) Thick			Ţ-Ţ	300 (422)	54(372)	22 (24)	0.415(10.5)	េ	0.75 (19.0) 1.5	-	38.1) 0.75(19.1)	
				<u>; - :</u>	70 (294)	63(434)	27(29)	0.459(11.7)	t	0.75 (19.0) 1.5	_	38,1) 0,75(19,1)	
				Ţ	70 (294)	64(441)	22(24)	0,295(7,5)	t	0.75 (19.0) 1.5)	38.1) 0.75(19.1)	
				S	70 (294)	61(421)	31 (34)	0.646(16.4)	5	0.75 (19.0) 1.5		(38.1) 0.75(19.1)	
				<u>_</u>	-65(219)	67 (462)	26 (28)	0.376(9.6)	5	0.75 (19.0) 1.5)	38.1) 0.75(19.1)	
				7	-65(219)	67 (462)	23(25)	0.295(7.5)	5	0.75 (19.0) 1.5)	38.1) 0.75(19.1)	
r8510	18510 Extrusion: 1,45 in		Λ, (n)	<u></u>	70 (294)	69(476)	30(33)	0.400(10.2)	Bend	1.01 (25.7)	3,0 (76.2)	:	42
_	(50.8 mm) III.CK			7-1.	70 (294)	66 (455)	18(20)	0.165(4.2)	Bend	0,375(9,5)	0.375(9.5) 0.937(23.8)	:	
T852	Forging: 2.0 in	В, 1	-	F-7	70 (294)	65 (448)	24 (26)	0.341(8.7)	Bend	0,750(19.1) 1,5	1.5 (38.1)	:	41
	(27.0 mm) inter	В, 1	-	1-1	70 (294)	64(441)	22 (24)	0,295(7,5)	Bend	0.750(19.1) 1.5	1.5 (38.1)	:	
							703						
							03×						

Table 46 (Cont.) ALIWINUM, Copper Alloy: 2024, 2124, DTD 5090 and A-24C! (Sheet 2 of ..)

据自然是是人工工程,就是我们的国际的经验,也不可以可以可以可以可以不是的人,这些是一种,这种,他们也是一种,我们也是一种,也是一种,也是是一种的人,也是一种的人

L													
		Sitten,			Yield	lypical Kr	/KIC \			Spe	Spec . men		
		Heat	Heat fest		نــ	1. 3)	2,5(0)					Crack	
emper	r Form	ment	t. n	01 lo	151 (NN/m ²)	KSIVIn (MS/m 2)	in (man)	1ype	inickness in (mm)	ness mm)	Nidth in (mm)	Length in (mm)	Ref
-	Forging: 6.0 in	C,1	1-1	70(294)	56(386)	30(33)	6.717(18.2) Bend 2.0 (50.8) 4.0	Bend	2.0	(50.8) 4	.0 (101.6)		4
	(134 mm) INICK		T-L	70(294)	58(400)	17 (19)	0.215(5.5) Bend 2.0 (50.8) 4.0 (101.6)	Bend	2.0	(50.8) 4	0. (101.6	:	
			S-L	70 (294)	54(372)	16(17)	0.219(5.6)	Bend	0.5	(12.7) 1.0	.0 (25.4)	:	
72	Plate: 1 in (25.4 mm) Thick	Λ, (α)	1-1	70 (294)	48(331)	31 (34)	0.41 (104)	SEN	1.0	(25.4) \$.0 (127)	1.0 (25.4) 5.0 (127) 1.6 (40.6)	40
1851	Plate: 2 in	E, (a)	T-,	74 (297)	66 (455)	24 (26)	0.331(8.4)	ಕ	0.75	0.75 (19.1) 2.0	.0 (50.8)	(50.8) 1.0 (25.4)	110
	(ססיה הפון וחוכא		1-1	74 (297)	65 (448)	23(25)	1,313(8.0)	C	0.75	(19.1) 2	.0 (50.8)	0.75 (19.1) 2.0 (50.8) 1.0 (75.4)	
005 OTO N	090 Plate: 3 in (76.2 mm) Thick	0,2	L-T	70 (294)	(6/2)75	41 (45)	1.441(36.6) (b)	(e)	!		:	ŧ	72
A-04G1 T351		D, -	T-S	76 (294)	50 (345)	24 (27)	0.576(14.6) Hend	hend	0.5	1 (7.21)	(12.7) 1.0 (25.4)	ł	09
T651		-'a	T-S	70 (2.54)	58(400)	22 (24)	0,360(9,1)	Bend	0.5	(12.7) 1.0	.0 (25.4)	į	
1881		٠,٥	T-S	70 (294)	61 (421)	24(27)	0.387(9.8) Bend 0.5	Bend		(12.7)	(12.7) 1.0 (25.4)	i	
(a) F	(a) Fabrication and Meat Treatment in accordance with Military, Federal, ASTM or Aluminum Association	ment in accord	lance with	Military, Fc	deral, ASTM or Al	luminum Association							`

Fabrication and Heat Treatment in accordance with Military, Federal, ASTM or Aluminum Association Specifications. Specimen in accordance with ASTM Recommendations.

æ

COMPOSITION

쇲		•		0.05M	•
핅				0.54	•
Ы	0.131	•			0.111
Ξĺ		0,02	5.03		0.158
u ₂	0.25M	0.07	0.08	0.21	0,254
뒤	0.68	0.53	0.65	. 6N	0.68
ŝ	0.5!	0.11	0.12	0.54	0.21
2	0.5%	0.15	0.14	0.5	0.3H
•••	1.5N	_	_	_	_
āl	4.3N	4.63	4.56	4.35%	4.35N
	< 1	x 0	ပ	2	w

HEAT TREATMENT

Solution Heat Treated, Cold Morked and Artificially Aged in accordance with Mil Specification MIL-II-6088D or Aluminum Standards and Data, Aluminum Association, April 1968 922F (768K), Mater Quench; Stretch 1.5-2.54 :

ALUMINUM	ALUMINUM, Copper Alloy: 2618, RR	2618, RR58, DTD 731, CM 003		1/40, A-U2GN	Ţ	fable 47					
		-odabo-				Typical	/K.c.\ ²		Specimen		
		Heat Treat-	Test Orienta-	:	Yield Strength	, ric	$\left(\frac{2.5 \left(\frac{15}{\sqrt{y_3}}\right)}{\left(\frac{y_3}{y_3}\right)}\right)$	Thickness	一	Crack	
Temper	Form	ment	tion	•F (•K)	XSI (MN/m²)	KSI√in \MN #	/ in (man)	Type in (mm)	in (mm)	in (m)	Ref.
2618											
T651	Plate: 1 in (34.9 mm) Thick	Λ, (a)	Ţ.	70(294)	58(400)	33(37)	0.85 (22.6)	Bend 1.0(25.4)) 2.0 (50.8)	1.0 (25.4) 37	1) 37
RRS8											
d.	Plate: 3 in (76.2	В,-	1-7	70(294)	60(414)	22(24)	0.336 (8.6)	Bend 0.75 (19.1)	1) 3.0 (76.2)	1.0 (25.4)	4) 62
		В,-	1-L	70(294)	58(400)	19(21)	0.268 (6.8)	Bend 0.75(19.1)	1) 3.0 (76.2)	1.0 (25.4)	e
		. 'a	S-L	70(294)	55(379)	20(22)	0.331 (8.4)	Bend 0,75(19.1)	1) 3.0 (76.2)	1.0 (25.4)	÷
	Forging	В,-	1-:	/0(294)	61(421)	24(26)	0.387 (9.8)	Bend 1.4 (35.6)	6) 0.38(9.7)	0.49(12.4)	4
DTD 731	=1										
di N	Forging		L-1	70(294)	58(400)	21(23)	0.328 (P)	Bend 0.38 (9.7)) 1.5 (38.1)	0.34 (8.6)	6) 62
			T-S	70(294)	\$8(400)	21 (23)	0.328 /)	Bend 0.38 (9.7)) 1.5 (38.1)	0.34 (8.6)	જ
****			7-S	70(294)	57 (393)	16(17.6)	0.197 ,5.0)	Bend 0.25 (6.4)) 0.75(19.1)	0.30 (7.6)	6
CM 003/40	/40										
d _X	Plate: 1.5 in (38.1 mm) Thick	c,1	L-1	70(294)	61 (423)	23(25)	0.355 (9.0)	(F)	;	i	72
	Plate: 3 in (7".2 mm) Thick	C, 1	<u>r-</u> 7	70(294)	60(417)	20(22)	0.278 (7.1)	(e)	t †	ł	
			L-T	70(294)	58(399)	17(19)	0.215 (5.5)	(b)	:	:	
			r-s	70(294)	55(376)	16(18)	0.212 (5.4)	(q)	i	į	
A-U2 GN	Zi.										
T 651		۸,-	T-S	70(294)	57(393)	21(23)	0.339 (8.6)	Bend 0.5 (12.7)	7) 1.0 (25.4)	;	62
T 652		Α,-	L-T	70(294)	58(400)	24(26)	0.428 (10.9)	Bend 0.5 (12.7)	7) 1.0 (25.4)	;	
(e) (e)	Fibrication and Heat Treatment in accordance Cederal, ASTM or Aluminum Association Specifi Specimen in accordance with ASTM Recommendati	ent in asco ssociation ASTM Recom	rdance with Specificati mendations.	with Military, cations. ons.		COMPOSITION	Cu Ng Si	Fe	Zn 171	Pb IN	1
II' AT II	II AT FREATHENT 1. 985F (803K), Mator Quenched; Stretch 1.5-	ched; Stret	ch 1.5-2,5	2.5%; Agod 373F (463F)		71< c = B > 71	2.3N 1.5N 0. 2.5N 1.5N 0. 2.2SN 1.5N 0.	0.25M 1.1N - 0.2M 1.0N - 0.25M 1.15N 0.2M	- 0.07N - 0.1N	- 0.0SM	1.05N 1.2N 1.1N
								1		- 1	

ALUMINUM, Zn-Mg Alloyr: 7001, 7049 and 7050 (Sheet 1 of 2)

ALUMINUM, Zn-Mg Alloy: 7001, 7049 and 7050 (Sheet	and 7050	-	of 2)	Table	48				
	Compo- sition.			Yjeld	Typica1 K.c	/K _{IC} \2	Sjecimen		
Temper Form	Heat Treat-	Test Orienta- tion	Torn F (°K)	Strength KSI (MN/m ²)	$\left(\frac{3}{\text{KSIVIn}}\left(\frac{3}{\text{NN/m}}\right)\right)$	in (mm) Type	Thickness Width in (mm)	Crack Length in (mm)	Ref
7001 775 Piate: 1,375 in (34,9 mm)	۸ , (a)	L-T	70(294)	71 (490)	24(26)	0.286(7.3) Bend	1.37 (34.8) 3.0 (76.2)	(76.2) 1.5 (38.1)	82
Thick		1-1	70 (294)	70 (483)	22 (24)	0,247(6,3) Bend	1.37 (34.8) 3.0 (76.2) 1.5	1.5 (38.1)	
Extrusion: 0.2 in (5.1 mm)	ů,	L-T	70 (294)	77(531)	20(22)	0.169(4.3) SEN	0.180(4.6) 2.0 (50.8)	(50.8) 0.67(17)	48
Inick		T-L	70 (294)	78(537)	20(22)	0.164(4.2) SEN	0.180(4.6) 2.0 (50.8)	(50.8) 0.67(17)	
Forging: 6.0 in (152.4 mm)	B,-	T-1.	70 (294)	70 (483)	21(23)	0.255(5.7) SEN	0.250(6.3) 2.0 (50.8)	i	49
inick		Ţ-Ţ.	70 (294)	71 (490)	16(17)	0.126(3.2) CN	0.185(4.7) 3.0 (76.3)	!	
		S-T	70 (294)	;	16(17)	704	1.0 (25.4) 0.813(20.6) 0.5 (12.7)	0.5 (12.7)	
7049 173 Forging: 5 in (127 mm) Thick	C, (a)	4	70 (294)	64 (441)	32 (35)	0,62 (15.8) (b)	!	! !	84
Integrally	0, (a)	1-1	75 (297)	75 (517)	28 (31)	0,348(8,9) CT	1.0 (25.4) 2.0 (50.8)	(50.8) 1.0 (25.4)	97
Stiffened: 18 x 11 x 3 in (457 x 279 x 76 mn)		T-L	75 (297)	75(517)	25(27)	0.278(7.1) CT	1.0 (25.4) 2.0 (50.8) 1.0	1.0 (25.4)	
		S-T	75 (297)	(69(169)	20(22)	0.216(5.5) CT	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
		L-T	-65(219)	79 (545)	25 (27)	0.250(6.4) CT	1.0 (25.4) 2.0 (50.8) 1.0	1.0 (25.4)	
		T-1.	-65(219)	78(538)	23(25)	0.217(5.5) CT	1.0 (25.4) 2.0 (50.8)	(50.8) 1.0 (25.4)	
Extrusion, 20 x 3,3 x 3;	(e)'.	L-T	70 (294	73(\$03)	33(36)	0,511(13) CT	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
(1831) O X PO X ODC)		T-1.	70 (294)	68 (469)	22 (24)	0.424(10.8) CT	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
		נ-יו	-65(219)	77(531)	31 (34)	0.477(12.1) CT	1.0 (25.4) 2.0 (50.8)	(50.8) 1.0 (25.4)	
		7-1	-65(219)	70 (483)	20 (22)	0.264(5.2) CT	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
7049 776 Extrusion: 20 x 3.3 x 3.5 in	D, (a)	L-1	70 (294)	76 (524)	33(36)	0,471(12) CI	1.0 (25.4) 2.0 (50.8)	(50.8) 1.0 (25.4)	97
(50) X 04 X 03)		T-L	70 (294)	69(476)	20(22)	0.210(5.3) CT	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
		L-1	-65(219)	80(552)	30(3%)	0.352(8.9) CT	1.0 (25.4) 2.0 (50.8) 1.0	1.0 (25.4)	
		1-1	-65(219)	72(496)	7249(21)	0.174(4.4) CT	1.0 (25.4) 2.0 (50.8)	(50.8) 1.0 (25.4)	

ALEMINUM, Zn-Mg Alloyr. 7001, 7049 and 7050 (Sheet 2 of 2)

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		Compo-	!			Typical	2 %		is	Specimen		一
		\$11011.			Yield	×1.3	1 \ 21/					-
		Heat	Fest		Strength	ź ~					Cruck	_
	-	Treat-	Ori anta-	Orienta-		(%)		Ε	hickness	Width	Length	
Temper	Form	ment	tian	c F (a K)	KSI ('IN/m")	KSIVin (MN/m - /		ype	in (mm)	in (nm)	in (mm)	
2650												
173651 P	Plate: 4 in (102 ma) Thick	m,	L-1	70 (294)	67(462)	35 (38)	0.682(17,3) CT 1.25(31.8) 2.5 (63.5) 1.25(38.1)	<u>.</u>	25(31.8)	2.5 (63.	5) 1.25(38.1)	
T7E56 112	T7ES6 Hand Forging: 5 x 10 in		I-1	70(294)	64(70)	29(32)	0.513(13.0) Bend 0.75(19.1) 1.5 (38.1) 0.75(19.1)	o puc	75(19.1)	1.5 (38.	(1.61) 57.0 (1	

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120

Heat Treatment in Accordance with Applicable Willtary, Federal, AST: or Aluminum Association Epecifications. Specimen in Accordance with ASTM Recommendations. <u>e</u> e

COMPOSITION						
	31	8	입	Si	뒤	Zn
<	2. IN	3.0N	0.4M	0.35M	0.3%	7.4N
£	2.26	3,03	0.16	0.12	0.04	7,61
Ų	1.48	2.45	0.13	0.0	0.01	7,5
۵	N. SN	2,5N	0,35%	0,25M	× 0	7.6N
ш	2:31	2.44	0.07	0.04	0.00	6.35

77

71 0.2N 0.02 0.03

0.28N 0.21 0.16 0.15N 0.01

ALUMINUM, En-Mg Alloy: 7007

Table 49

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	Ref.	1 2		8 0.			 		
	Crack Length in (mm) R	0.903(23.1) (b) 1.0 (25.4) 2.0(50.8) 1.0 (25.4) 37	1.0 (25.4) 2.0(50.8) 1.0 (25.4)	1.0 (25.4) 7.0 (50.8) 1.0 (25.4)	1.0 (25.4)	1.0 (25.4)	1.0 (25.4) 2.0(50.8) 1.0 (25.4) 43	1.0 (25.4) 2.0(50.8) 1.0 (25.4)	
Specimen	Width in (mm)	2.0(50.8)	2.0(50.8)	7.0 (50.8)	1.0 (25.4) 2.0 (50.8) 1.0 (25.4)	1.0 (25.4) 2.0 (50.8)	2.0(50.8)	2.0(50.8)	
Sp	Thickness in (sm)	1.0 (25.4)		1.0 (25.4)	1.0 (25.4)	1.0 (25.4)		1.0 (25.4)	
	Type	a	<u>@</u>	ษ	5	ธ	Bond	Bend	
_	1.5 (0/ys) tn (mm)	0.903(23.1)	0.719(18.3) (b)	0.606 (15.4) CT	0.207 (5.2)	0.271 (6.9)	0.999(25.?)	0.685(17.4) Bend	
Typical	$\begin{cases} x_1 \\ x_2 \\ x_3 \\ x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_6 \\ x_6 \\ x_6 \\ x_7 \\ x_8 \\ x_$	44(48)	37 (40)	32(35)	23(25)	28(193)	46 (50)	37 (40)	
;	Yield Strênge's KSI (MW/m ²)	73(503)	69 (476)	ს5(448)	80(552)	85 (586)	73(503)	(9(476)	
	Temp	70(294)	70(294)	70(294)	-521(77)	-423(22)	70(294)	70(254)	
	Test Orionta-	r-1	T-L	1-1	T-1.	T-I.	11	1-L	
Compo-	Heat Treat-	Λ, (a)					۵,1		
	Form	Plate: 1.0 in (25.4 mm) Thick					T6E136 Plate: 1.6 in (25.4 nm) Phick	•	
	Temper	7007 F6					T6E136		

(a) Tabrication and Heat-Treatment in accordance with Aluminum Association Specifications. (b) Specimen in accordance with ASIM Recommendations.

COMPOSITION

CH Mg Si FC Mn Zn Ti Cr ZI Ag

A 0.254 1.8X (0.4H total) 0.4M 6.5X 0.04X 0.12X 0.12X
B 0.06 1.7x 0.05 0.11 6.21 6.55 0.03 0.11 0.10 .

HIXT TREARMENT

1. 860f (734k), Controlled Moderate Quench; Stretched 1.5 to 3%; Aged 275f (408k), 16 Hr

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TO SERVICE STATES OF THE PROPERTY OF THE PROPE

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Table 50 ALIMINUM, 2n-Ng Alloys: 7075, UTD 5050, UTD 5074, BSL 95, AZ 74, and 7175 (Sheet 1 of 4)

		Common	1			Timbool	<u></u>					
		sition,			Yield	Krc	/K1C 1		Spi	Specimen		
		ileat Treat-	Test Orienta-	l cmp	Strength	, -3	2.5(g_)		Thickness	Kidth	Crack Length	
remper	r Form	ment	tion	(30) 10	ksi ("i\\m")	KSIVIn \MN/m 2 /	in (man)	Турс	in (mm)	ın (mm)	in (nm)	Ref
7075	Plate: 3 in (76.2 mm) Thick	۸,1	T-S	70 (294)	63 (435)	26 (28)	0.459{11.7)	(p)	:	ì	i	76
T651	Plate: 0.5 in (12.7 mm) Thick	A, (a)	1-1	70(294)	73(503)	25 (27)	0.290(7.4)	(P)	0.5 (12.7) 1.0	1,0 (25,4) 0,5	.5 (12.7)	37
	Plate: 1.375 in (44.5 mm)	Λ, (a)	T-1.	70 (294)	74(510)	19(21)	0.165(4.2)	(p)	1.75 (44.4) 5.0		(76.2) 1.75 (44.4)	
	HICK	A, (a)	7 - S	70 (294)	;	15(16)	į	(<u>a</u>)	1.75 (44.4) 3.0		(76.2) 1.75 (44.4)	
	Plate: 1.375 in (34.9	A, (a)	L-T	70 (294)	75(517)	28(31)	0,350(8,9)	Bend	1,375 (34.9) 3.0	3.0 (76.2) 1.5	1.5 (38.1)	38
	וווכא וווכא	Λ, (a)	T-L	70 (294)	78(537)	23(25)	0.218(5.5)	i	i	;	;	
	Plate: 1.375 in (34.9	A, (a)	T-1	70 (294)	78(537)	21 (23)	0.180(4.6)	Bend	1,390(35,3)	5.0 (76.2) 1	1.5 (38.1)	39
	מתו) ווונכא	A, (a)	T-I.	-112(193)	83(572)	23(25)	0,193(4.9)	Bend	1,390(35.3) 3	3.0 (76.2) 1	1.5 (38.1)	
		A, (a)	T-L	-320(78)	92 (633)	25 (27)	9,185(4,7)	Bend	1,390(35,3)	1,390(35,3) 3,0 (76,2) 1,5	1.5 (38.1)	
	Plate: 4 in (101.6 mm) Thick	Α,2	T-S	70 (294)	67(459)	22 (24)	0,270(6.8)	(p)	;	i	į	76
T6511	Extrusion: 0.688 in	Λ, (a)	<u>r-1</u>	70(294)	79(544)	26 (28)	0,277(7.0)	(a)	0.625(15.9)	0.625(15.9) 1.25 (31.8) 0.625(15.9)	(675(15,9)	57
	(17.5 cm) INICA	A, (a)	T-1.	70 (294)	75(517)	25 (27)	0.278(7.1)	(2)	0,625(15.9)	1.25 (31.8) 0	(31.8) 0.625(15.9)	
	Extrusion: 3.5 in	A, (a)		70(294)	75(517)	31 (54)	0.427(10.8)	(a)	1.5 (30.1)	3.0 (76.2) 1	(76.2) 1.5 (38.1)	
	V2111 (1977)	Λ, (a)	7-1.	70 (294)	67 (462)	21 (23)	0.246(6.3)	(e)	1.5 (39.1)	3.0 (76.2) 1	1.5 (38.1)	
		Λ, (α)	7-S	70 (294)	61(421)	19(21)	0,242(6,2)	CT	1.0 (25.4)	2.0 (50.8) 1.0	1.0 (25.4)	13
17351	Plate: 1.375 in	A, (a)	T-1.	70 (294)	57 (393)	28(31)	0,603(15,3)	Bend	1,375 (34.9)	3.0 (76.2) 1.5	1.5 (38.1)	39
	111. (int. 6.40)	A, (a)	1-1	-:12(193)	59 (407)	28(31)	0,565(16.6)		1,375(34.9)	3.0 (76.2) 1.5	1.5 (38.1)	
		Λ, (a)	1-1	-320(78)	66 (455)	29(32)	0,483(12,3)		1,375(34,9)	3.0 (76.2) 1.5	1.5 (38.1)	
	Plate: 1.0 in	A, (a)	<u>[-1</u>	70(294)	67 (462)	33(36)	0,606(15,4)	SLN	1.0 (25.4)	5.0 (127.0) 1.6	(40.6)	40
	VA. (2011 - 1.04)	Λ, (a)	T-1.	70 (294)	(5 (448)	27(29)	0.431(10.9		1.0 (25.4)	(25.4) 5.0 (127.0) 1.6	1.6 (40.6)	
					. •	73<						

Table 50 (Cont.) ALUMINUM, Zn-Mg Alloys: 7075, UTD 5050, UTD 5074, BSL 95, AZ 74, and 7175 (Sheet 2 of 4)

		_			1.1	Typical	/K,c 2	ds	Specimen		
			lest		Strength	AIC 3	(31.8/0.8)			Crack	
Тепрег	r Form	Treat- ment	Orienta-	0, 1.m.i	151 ('m'm')	KSIVIn (MN/m 2)		Thicknes7 in (mm)	Width in (mm)	Length in (mm)	Ref
	Plate: 1.0	:] -! [70(294)	58(400)	34(37)	0.859(21.8) Band	0.55 (14)	1.02 (26)	0.55 (14)	27
	(25.0 mm) Throk		7-L	70 (294)	57(393)	28(31)	0,603(15,3)	1.0 (25.4) 2.0	2.0 (50.8) 1.6	1.0 (25.4)	
	Plate: 21n (50.8 m) Trick	Λ,3	T-5	70 (294)	66 (452)	27(30)	0.418(10.6) (5)	:	t t	ë † 1	9/2
	Plate: 4 in (102 mm) Phick	I, (a)	T	70 (294)	53(365)	31 (34)	0.855(21.7) CT	1.25 (31.8)	2.5 (63.5)	(63.5) 1,25 (31.8)	911
	Forging: 1.1 in	;	1-1	70(294)	58(400)	33 (36)	0.809(20.5) Bend	1.0 (25.4) 2.0	2.0 (50.8) 1.0	1.0 (25.4)	
	(27.9 mm) Thick		7	70 (294)	58(400)	22(24)	0,359(9.1)	1.0 (25.4) 2.0	2.0 (59.8) 1.0	1.0 (25.4)	
			1-5	70 (294)	54(370)	27(30)	0.625(15.9) Bend	9.5 (12.7) 1.0	1.0 (25.4)	:	09
7075 173511	7075 [735]] Lxtrusion: 0.688 in	λ, (α)	[- <u>1</u>	70 (294)	64(441)	14(37)	0,706(17.9) (h)	0.625(15.9) 1.25 (31.8) 0.625(15.9)	1.25 (31.8)	0.625(15.9)	37
	(17.5 mm) Ihick	λ, (a)	l-f.	70(294)	(27.)29	30 (32)	0,585(14.9) (b)	0.625(15.9) 1.25		(31.8) 0.625(15.9)	
	Extrusion: 3.5 in	λ, (a)	1-J	70 (294)	64(441)	35 (38)	0.748(19.0) (b)	1.5 (38.1)	3.0 (76.2)	1.5 (38.1)	
	(88.9 mm) Thick	A, (a)	r-t.	70 (294)	58(400)	24(26)	0,428(10.5) (b)	1.5 (38.1)	3.0 (76.2)	1.5 (38.1)	
		(۵) ٬۷	S-1.	70(294)	54 (372)	20 (22)	0.343(8.7) CT	1.0 (25.4)	2.0 (50.8)	1.0 (25.4)	19
F7352		8,1	Ĺ-1	/0(294)	65 (448)	31 (34)	0.569(14.4, Bend	0.75 (19.0) 1.5	1.5 (38.1)	į	41
	(50.8 rm) Ihrek		T-L	70 (294)	65 (448)	24(26)	0.341(8.7)	0.75 (19.0) 1.5	1.5 (38.1)	į	
	forging: 6.0 in	C,1	L-T	70 (294)	55 (379)	40 (44)	1,322(33.6)	2.0 (5'.4) 4.0	4.0 (101.6)	;	
	(152, 1 mm) Thick		1-T	70 (29 1)	50(345)	28(31)	0.784(19.9)	2.0 (50.4) 4.0	4.0 (101.6)	į	
			γ . Γ.	70 (291)	49 (338)	26(28)	6,703(17.9)	2.0 (50.4) 4.0	4.0 (101.6)	i	
	forging: 6.0 in	1, (a)	S-1	70(294	56 (386)	22 (24)	0.386(9.8) Bend	0,7 (17.8) 1.4		(35.6) 0.7 (17.8)	=======================================
	Halla may misek		3	70 (294)	56 (386)	20(22)	0.319(8.1; Bend	0.7 (17.8) 1.4	1.4 (35.6) 0.7	0.7 (17.8)	
173	lorging	λ, (α)	<u>5-1</u>	70 (294)	57 (393)	30 (32)	0.692(17.6) Bend	0.5 (12.7) 1.0	1.0 (35.	;	Ç
17651	Plate: 2 in (50,8 mm) Thick	(,, (,,	-1	(667)08	65(448)	7 6 <	0,431(1!) CI	0.8 (20.3)	2.0 (50.8)	(50.8) 1.0 (25.4)	e
											_

Table 56 (Cont.) ALUMINUM, Zn.Ng Alloys: 7075, 14D 5050. PT 5074, 851 95, AT 72. (Sheet 3 of 1)

				(transfer of (cont.)	(cont.)				
	Conne-				Pypical	2 4				
-	llea.	Test.		Strength	Frc ,	1.5(F)	2	Specimen	406.	T
temper Font	aent aent	Ur? eat a-	9F (9K)	_	KSIVIN (MN/m-2)	~	Thickness in (mm)	Width in (more)	Le '3th in (ma)	Ref
T7.511 Extrusion: 0.688 in (17.5 m) Thick	۷°) ′۷	ŗ.,	79(204)	67(462)	33(36)	0.696(15.4) (b)	0,625(11,9)	0.625(1".9) 1.25 (31.8) 0.62 .3.9)	0.62 3.9)	33
	Ας (α)	77.	70 (294)	64 (441)	30 (33)	0,549(13,9) (b)	0.625(15.9)	0.625(15.9) 1.25 (31.8) 0.625(15.9)	.625(15.9)	,
UTD 505(N:7 Plate: 3 in (76.2 mm) Thi 1.k	F,2	T-1	70 (294)	76(527)	25 (27)	0,271(6,9) (b)	!	!	;	*
-		S-7	70 (294)	76 (522)	28(31)	0.339(8.6)(b)	. !	*	;	,
	7,7	T-L	70 (394)	70 (482)	21 (23)	a.225(5.7)(b)	•	ł	į	
		r-s	70(294)	70 (482)	22 (24)	0.247(6.3)(b)	**	:	;	
	F,-	S-1	70(294)	65(445)	20(22)	0.237{ 6.0) (b)	i	ì	ł	
6.202 OLG		S-T	70(294)	65 (445)	21 (23)	9.261(6.6) (h)	;	ŧ	į	
hp Piate	e e	!	70 (294)	70 (483)	27 (29)	0.3724 9.40 Bend	0.38 (9.7)	0 75 (19.1) 0.34 (8.6)	.34 (8.6)	:3
.P '.xtrusion	P,-	7	70 (294)	87(572)	33(36)	0.395(10.0) bond	0.32 (8.1) 1.5	1.5 (38.1) 0.45	.45 (11.4)	62
		1	78(294)	74(\$10)	24(26)	0.263(6.7) Ber.1	0.25 (6.4)	0.25 (6.4) 0.75 (19.1) 0.23 (5.8)	.23 (5.8)	·
BSL 95 hF Plate: 7 in (76.2 mm) Thick	E, 2	T-S	70 (294)	75 (\$14)	24 (26)	0.256(6.5) (h)	į	ţ	1 2 1	76
77 74 Plate: 4.5 in (11. 3 mm)	6,-	1-1	70 (294)	60(411)	25 (27.5)	0.43!(10.8)(b)	į	;	_	92
		r-S	70 (294)	;	22 (24)	(q)	1	;	:	
Cand Corging: 1.1 in (28.4 mm) Thick	1,	T-/1	70 (294)	71 (490)	26(29)	0.335(8.5)(b)	;	:	i	27
		2.5	70 (294)	67 (462)	25(27)	0.347(8.8)(b)	;	i	i	
T61	1	T-S	70 (294)	69 (476)	29 (32)	0.442(!1.2) Bend	6.5 (12.7) 1,0	(35.4)	i	- 09
J	,! 1	7-S	(162)02	66 (455)	18(20)	0.19 (4.7) Bend	0.5 (12.7) 1.0	.0 (25,4)	i	
166 Bir Lorging: 3 in 76.2 mm) Max. Rickings	н,3	r-1	70 (294)	80 (552)	34(37)	0,452(11,5) (b)	i	ļ	i	37
7.7.V		T-L	70 (294)	70 (483)	25 (27)	0.319(8.1) (b)	•	•	ł	
.		3-;	70 (294)		21 (23)	(a)	:	;	!	
										_

Table 50 (Cont.) ALEMININ, Zn-Ng Alloys: 7075, UTD 5050, DND 5074, BSL 95, AZ 74, 7175 (Sheet 4 of 4)

	And the second s	Compo-			Viold	Typical	/Krc \2		Š	Specimen		-
		Sitton, Heat	Test		Strength	"IC (3)	2.5(This obsess	Wicheh	Crack	
	Form	Treat.	Treat. Orienta- ment tion	or (ok)	KSI (PIN/m ²)	KSIVIn (MN/m ⁻²)	in (nm) Type	Type	in (pm)	in (mm)	in (mm)	Ref
1736	Die Forging: 3 in	н,3	L-7	76(294)	72(496)	35 (38)	0,591(15) (b)	(1	;	!	37
	(76.2 mm) Max. Thickness		1-1	70(294)	(29(140)	26(28)	0,376(9,6)(b)	@	:	i	:	
			S-L	70 (294)	i s	27 (29)	i	(ţ	i	i	
.,	Forging: 2.5 in	н,3	T-Ŀ	70 (294)	66(455)	23(25)	0.304(7.7) CT		1.0 (25.4)	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	66
	(63.5 mm) Square		S-T	70(294)	65 (448)	32(35)	0.606(15.4) CT		1.0 (25.4)	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	
			S-T	0(256)	δό (455)	27 (29)	0.419(10.6) CT		1.0 (25.4) 2.0 (50.8)	2.0 (50.8)	1.0 (25.4)	
			S-T	.65(219)	67 (462)	26'28)	0.376(9.6) CT		1.0 (25.4)	1.0 (25.4) 2.0 (50.8)	1.0 (25.4)	<u></u>
<u>.</u>	(a) E. Fion and Heat Treatment in accordance with Aluminum Association Specifications.	t in accor	Jance with	Aluminum Asse	ociation Specifi	cations.						

COMPOSITION

						(Cr + Mn 0.18-0.5)	<u>.</u>		
প্ল	•	•	•	•	•		0	٠	•
ଣ	•								
z									
디	0.271	0.93	0.03		,	ž C	•	F.	<0.2
비	0.3N	0.19	0.19					0.248	0.18
<u>5</u>	S.6N	5,65	5.68	5.8%	5.8	5.85%	5,85	5.68	5.1
Ë	0.3I	0.02	0.02	0.15M	S. 50	0.1M	¢0.03	0.013	0.07
	٠ ۲	0.13	0.14		0.54	0.5M	0, 15	0.2%	0.23
Si	0.531	0.10	0.10		0.41	0.SN	٠ 0	6.15%	<0.2
뙭	2.5%	2.50	2.60	2.58	2.5%	 	2.5	2.5.	2.27
3i	1.68	1.6	4,4	1.4N	1.68		0.92	1.58	1,55
	4	. 20	Ü	-	ند	i i	v	=	-

HEAT TREATMENT

- Stress Relieved and Aged to meet requirements of paragraph 4.10 of Federal Sp. (QQA-367g, paragraph 4.6.5.1 NIL Spec. NILA-22771C. 859F (733K), Water Quenched, Stretch 1.5-2.51; Aged 275F (405K). Proprietary Heat Treatment.

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Recommendations

Composition, Fabrica ion and Heat Treatment in accordance with Aluminum Association Specifications (b) Specimen in accordance with ASTM

5

0.625(15.9) 1.25(31.8) 0.625(15.9)

ê

0.365(9.3)

26(28)

79 43(25)

90(620) 83(573)

70(294)

1-1

A, (a)

Extrusion: 0.4 in (10.2 mm) Thick

162

3

70(294)

68(470)

70(294)

1-1

<u>e</u>

0.442(11.2)

29(32)

69(476)

70(294)

1-1

A, (a)

Extrusion: 6.688 in (17.5 mm) Thick

T76511

(b) 0.404(10.3) 1.5 (38.1) 0.512(7.9) 0.940(23.9)

<u>e</u>

0.192(4.9) 0.163(4.1)

23(25)

(Co.: t.)
Table S1 (Coxt.)
7178 and DTD 363 (Sheet 2 of 2)
nd DTD 363 (
7178 ai
. 2n-Mg Alloys:
2n-7.6
LUMINIM,

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,									 		 	 	
		Ref.		62									
		Crack Length in (mm)		2.6.(66) 0.75(19.1)									
	Specimen	Width in (mm)		2.6 .(66)				-					
	S	Thickness in (mm)		0.8 (20.3)									
		Туре		Bend									
	/ ^K IC\ ²	$\frac{2.5}{\text{co}} \left(\frac{9}{\text{ys}} \right)$		0.259 (6.6) Bend 0.8 (20.3)									
(1)	Ppicel	$KSI\sqrt{2n} \left(\frac{3}{NN m^{-\frac{3}{2}}} \right)$		28(31)									>08
(tiliza) is assum		Yield Strength KS((MN/m ²)		87(600)									~
		(γ. (•)		94)		히	0.29N 0.3M						
:		Temp °F (°K)		70(294)		리	0.2M						
to a position of the property of the state o		Test Oriente- tion		L-7		되	SH 6.8N 6.8N						
	ombo-	Heat Treat-		, B		된	1 0.3M						
						의	0.7M						
						Si	0.SM						
				e e		쮥	2.75N 2.7N						
		, and	İ	Extrusion	10N	리	2.0N 2.0N						
		Temper	DTD 363	Ç.	COMPOSITION		≪ 25						
		7	L	_					 	 	 	 	

THE PARTY OF THE P

			<u>"</u>	Compo-			Ploix	Typical K.	/K _{IC} \2		Specimen		
,					les. Or ren a-	<u>-</u> 		-1C -3	71	Thickness	Width	Crack Length	
lemper	Form		1	36.38	1302	(Yo. Y.)	KSI ('IN/m")		in (mm) Type	e 1n (mm)	in (mm)	in (nm)	Ref
70.59	lorging: 4.0 in	in		۸,1	T-1.	70 (294)	57 (393)	19(21)	0.277(7.0) KOL		4.0 (101.6) 10.2 (259) 4	4 (101.6) 45	45
Ë	(101.6 m) Thick	.			<u>.</u> .	0(256)	59(407)	17(19)	0.208 (5.3) NOL		4.0 (101.6) 10.2 (259)	4 (101.6)	
1651 Fla	Plate: 2.0 in	e ·		24,83	T-L	75 (294)	49 (338)	29 (32)	0.877(22.3) Bend 1.75(44.5) 3.5 (89)	1 1.75(44.5)	3,5 (89)	1,75(44.5)	7
ತ 	(50.8 mm) inick	ฮ์			÷	-100(200)	53(365)	30(33)	0.804(20.4) Bend 1.75(44.5)	1.75(44.5)	3.5 (89)	1.75(44.5)	
					7-1	-321(78)	58(400)	31(34)	0.715(18.2) Bend 1.75(44.5) 3.5 (89)	1 1,75(44.5)	3.5 (89)	1.75(44.5)	
100 mg/s	Plate: 3 1n			C, (a)	<u>:</u>	70 (294)	53(365)	47(51)	1.966(49.9) Bend 3.0 (76.2)	1 3.0 (76.2)	6.0 (152)	3.0 (76.2)	96
<u></u> _	("6.2 ma) Ihick	á			T-L	70(294)	52 (359)	40 (44)	1,479(37.8) Rend	1 3.0 (76.2)	6.0 (152)	3.0 (76.2)	
					7-S	70 (294)	48(331)	18(31)	0.851(21.6) CT	1,25(31,8)	2,5 (635)	1,25(31,8)	
(b) pres	abrication, and Heat Treatment in accordance will president in Accordance with ASIN Recomendations	d Heat Tr ordance w	eatment ith ASTM	in accor Recomie	dance wit	th Aluminum	(i) Tabrication, and Heat Treatment in accordance with Aluminum Association Specification (b) prefire in Accordance with ASTM Recomendations	cification					
COTPOST1108	ć												
	٥l	<u>સ</u> જા	Sı Fe	N.	ភ្យ	비	77						
 ,		2.5	0.3M 0.4M 6.3M 0.4M 0.35M 0.3S	0.44 0.25N 0.4M 0.25N 0.35H 0.45N	5N 4.0N 5N 3.75 5N 4.6N	0.3 0.3% 0.13%	0.14 - 0.14 - 0.03N 0.13N						

8501 (728.), 4 Ur, Aged 320f (433K), 18 Hr
 8501 (728.), 2.5 Hr, Water Quench, Age Room Temperature, 8 Hr, Age 320f (433K), 18 Hr

Figure Figure	In-Mg-Mn Alloy:	11toy: 7079	•			lable 53								
Treat			Cempo-				Typical	/Krc\ ²			eás	cimen		
A, 1 L-T 70 (29-4) 75 (517) 25 (247) 10 (mm) 17ppc 10 (mm)	:		Heat Treat-		Тепр	Yiel. Strength	ن	$\left(\frac{2.5}{3}\left(\frac{\frac{1}{3}}{3}\right)\right)$		Thickne		Width	Crack Length	
A, (a) T-L 70(294) 75(517) 2:(34) 0.215(15.5) SBN 1.0 (25.4) 5.0 (127.0) 1.6 (40.6) A, 1 L-T 75(297) 51(441) 32(35) 0.625(15.9) MOL 2.0 (50.8) 2.25(57.3) 1.0 (25.4) 1L 75(297) 64(441) 23(31) 0.5304(12.7) MOL 2.0 (50.8) 2.25(57.3) 1.0 (35.4) 1L -75(214) 69(47.6) 33(30) 0.5304(12.7) MOL 2.0 (50.8) 2.25(57.3) 1.0 (35.4) 1T -70(294) 75(517) 25(27) 0.5305(10.0) Bmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) 1L -112(183) 61(558) 26(27) 0.277(7.0) Bmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) 1L -112(183) 61(58) 26(27) 0.272(6.0) Bmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) 1L <td< th=""><th>s l</th><th></th><th>ment</th><th>tion</th><th>a. (o.)</th><th>KSI (MX/m⁻)</th><th></th><th>in (mm)</th><th>Type</th><th>in (ma</th><th>\exists</th><th>in (mm)</th><th>in (ma)</th><th>Ref.</th></td<>	s l		ment	tion	a. (o.)	KSI (MX/m ⁻)		in (mm)	Type	in (ma	\exists	in (mm)	in (ma)	Ref.
A,1 L-T 75(297) 91(411) 32(35) 0.625(15.9) WOL 2.0 (50.8) 2.25(\$7.3) 1.0 (25.4) 1-L 75(214) 69(476) 33(36) 0.570(14.5) WOL 2.0 (50.8) 2.25(\$7.3) 1.0 (25.4) A, (a) L-T -75(214) 69(476) 33(36) 0.570(14.5) WOL 2.0 (50.8) 2.25(\$7.3) 1.0 (25.4) A, (a) L-T -75(214) 69(476) 33(36) 0.570(14.5) WOL 2.0 (50.8) 2.25(\$7.3) 1.0 (25.4) A, (a) L-T 70(294) 75(517) 25(27) 0.250(1.0) Bond 1.35(34.9) 3.0 (76.2) 1.5 (38.1) A, (a) L-T 70(294) 74(510) 27(29) 0.220(5.6) Bond 1.35(35.1) 3.0 (76.2) 1.5 (38.1) A, (a) L-T 70(294) 71(490) 21(29) 0.417(10.0) Sin 1.35(35.1) 3.0 (76.2) 1.5 (13.1) 1.5 (38.1) 3.1 (2.7) B, (b)	_ 0	.4	A, (a)	J-L	70(294)	75(\$17)	22(24)	0.215(5.5)	SEN			5.0 (127.0)	1.6 (40.6)	07
1-L 75(297) 64(441) 28(31) 0.503(12.7) WOL 2.0 (50.8) 2.25(57.3) 1.0 (25.4) A, (a) L-T -75(214) 69(476) 33(36) 0.539(10.0) 8cmd 1.375(34.9) 2.25(57.3) 1.0 (25.4) A, (a) L-T -70(294) 75(517) 25(27) 0.237(7.0) 8cmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) T-L -112(183) 61(558) 26(28) 0.237(7.0) 8cmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) T-L -112(183) 61(558) 26(28) 0.227(7.0) 8cmd 1.375(34.9) 3.0 (76.2) 1.5 (38.1) A, (a) L-T -0.2207 (38) 20.2207 (5.6) 8cmd 1.356(34.9) 3.0 (76.2) 1.45(36.8) A, (a) L-T 70(294) 71(490) 27(29) 0.439(11.1) 8ix 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 1.5 (38.1)		in	۸,1	T-1	75(297)	53(441)	32(35)	0.625(15.9)	70x		50.81	2.25(57.3)	1.0 (25.4)	=
A, (a) L-T -75(214) 69(476) 33(36) 0.539(10.5) 600 2.0 (50.8) 2.25 (57.3) 1.0 (25.4) A, (a) L-T 70(294) 78(533) 21(34) 0.395(10.0) Bend 1.375(34.9) 3.0 (76.2) 1.5 (38.1) T-L -112(193) 61(558) 26(28) 0.220(5.6) Bend 1.375(34.9) 3.0 (76.2) 1.5 (38.1) A, (a) (-T -112(193) 61(627) 27(29) 0.220(5.6) Bend 1.380(35.1) 3.0 (76.2) 1.45(36.8) A, (a) (-T -320(78) 91(627) 27(29) 0.220(5.6) Bend 1.380(35.1) 3.0 (76.2) 1.45(36.8) A, (a) (-T -320(78) 91(627) 27(29) 0.220(5.6) Bend 1.380(35.1) 3.0 (76.2) 1.45(36.8) A, (a) (-T -70(294) 71(490) 29(32) 0.417(10.6) Six 0.5 (12.7) 1.5 (13.1) 1.5 (13.1) 1.5 (13.1) 1.5 (13.1) 1.5 (13.1) 1.5 (13.1) 1.1 (17.0) 1.1 (17		5		I-1	75(297)	64(441)	28(31)	0.503(12.7)	MOI.		50.8)	2.25(57.3)	1.0 (25.4)	
A, (a) L-1 /0(294) 78(533) 21(34) 0.395(10.0) Bend 1.375(34.9) 3.0 (~6.2) 1.5 (38.1) T-1 70(294) 75(517) 25(27) 0.277(7.0) Bend 1.375(34.9) 3.0 (~6.2) 1.5 (38.1) T-1 -112(193) 41(558) 26(28) 0.258(6.6) Bend 1.380(35.1) 3.0 (~76.2) 1.65(41.9) A, (a) L-T -320(78) 91(627) 27(29) 0.220(5.6) Bend 1.380(35.1) 3.0 (~76.2) 1.65(41.9) A, (a) L-T 70(294) 71(490) 29(32) 0.417(10.6) Six 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) B, (b) L-T 70(294) 71(490) 29(32) 0.417(10.6) Six 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) B, (b) L-T 70(294) 71(490) 29(32) 0.417(10.6) Six 0.5 (19.1) 1.5 (38.1) 0.5 (12.7) B, (b) L-L 70(294) 64(441) 30(33) 0.549(15.9) Bend<				1-1	-75(214)	69(476)	33(36)	11.570(14.5)	¥OI.			2.25(57.3)	1.0 (25.4)	
T-1 70,294 75(517) 25(27) 0.277(7.0) Bend 1.375(34.9) 3.0 (76.2) 1.5 (38.1) T-1 -112(183) 61(558) 26(28) 0.258(6.6) 8end 1.380(35.1) 3.0 (76.2) 1.65(41.9) A, (a) L-T -320(78) 91(627) 27(29) 0.220(5.6) 8end 1.380(35.1) 3.0 (76.2) 1.45(36.8) A, (a) L-T 70(294) 74(510) 31(34) 0.439(11.1) 5kN 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) B, (b) L-T 70(294) 71(490) 29(32) 0.417(10.6) 5kN 0.75 (19.1) 1.5 (38.1) 0.5 (12.7) B, (b) L-T 70(294) 65(448) 25(27) 0.370(9.4) 8end 0.75 (19.1) 1.5 (38.1) 0.5 (12.7) C, (b) L-T 70(294) 64(441) 30(33) 0.549(15.9) 8end 0.75 (19.1) 1.5 (38.1) 0.5 (in	Λ, (a)	:	/0(294)	78(533)	31(34)	0.395(10.0)	Bend			3,0 (~6.2)	1.5 (38.1)	35
T-i112(193) 61(558) 26(28) 0.258(6.6) 8end 1.380(35.1) 3.0 (76.2) 1.65(41.9) A, (a) iT 70(294) 74(510) 31(34) 0.439(11.1) 5i.N 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) B, (b) iT 70(294) 71(490) 29(32) 0.417(10.6) 8i.N 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) B, (b) iT 70(294) 64(441) 30(33) 0.549(15.9) 8end 0.75 (19.1) 1.5 (38.1) C, (b) iT 70(294) 5£(400) 24(26) 0.428(10.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 24(26) 0.428(10.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 1.5 (30.3) 0.549(15.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (19.1) 0.75 (191.6) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (19.1) 1.5 (38.1) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 8end 0.75 (191.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 1.0 (20.8) 0.40 (101.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 1.0 (20.8) 0.40 (101.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 1.0 (20.8) 0.40 (101.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 1.0 (20.8) 0.40 (101.6) 0 T-L 70(294) 5£(400) 1.5 (20.3) 0.428(10.9) 1.0 (20.8) 0.40 (101.6) 0 T-L 70(294) 5£(400) 1.5 (20.8) 0.41 (20.8) 0.41 (20.8) 0.41 (20.8) 0.41 (20.8	4	4		T~T	70(194)	75(517)	25(27)	0.277(7.0)	Bend			5.0 (76.2)	1.5 (38.1)	
A, (a) (a)<				T-1.	-112(193)	61(558)	26(28)	0.258(6.6)	Bend		35.1) 1	5.0 (76.2)	1.65(41.9)	39
A, (a) L-T 70(294) 74(510) 31(34) 0.439(11.1) SiN 0.5 (12.7) 1.5 (13.7) 0.5 (12.7) 0.5 <td></td> <td></td> <td></td> <td>Ì</td> <td>-320(78)</td> <td>91(627)</td> <td>27(29)</td> <td>0.220(5.6)</td> <td>Bond</td> <td></td> <td></td> <td>5.0 (76.2)</td> <td>1.45(36.8)</td> <td></td>				Ì	-320(78)	91(627)	27(29)	0.220(5.6)	Bond			5.0 (76.2)	1.45(36.8)	
T-L. 70(294) 71(490) 29(32) 0.417(10.6) SLN 0.5 (12.7) 1.5 (38.1) 0.5 (12.7) 8, (b) L-T 70(294) 71(490) 28(31) 0.389(9.9) End 0.75 (19.1) 1.5 (38.1) 8, (b) L-F 70(294) 65(448) 25(27) 0.370(9.4) End 0.75 (19.1) 1.5 (38.1) C, (c) L-F 70(294) 64(441) 30(33) 0.549(13.9) End 2.0 (50.8) 4.0 (101.6) 7-L 70(294) 52(400) 16(20) End 0.2 (12.7) 1.0 (25.4) 8-L 70(294) 88(400) 16(20) 16(20) End 0.5 (12.7) 1.0 (25.4)	;_;	5 in	Α, (a)	t-1	70(294)	74(510)	31 (34)	0.439(11.1)	SEN		12.7)	1.5 (38.1)	0.5 (12.7)	4
8,(b) L-T 70(294) 71(490) 28(31) 0.389(9.9) End 0.75 (19.1) 1.5 (38.1) 8,(b) L-I 70(294) 65(448) 25(27) 0.370(9.4) Bond 0.75 (19.1) 1.5 (38.1) C,(b) L-I 70(294) 64(441) 30(33) 0.549(13.9) Bond 2.0 (50.8) 4.0 (101.6) T-L 70(294) 52(400) 15(20) 0.428(10.9) Bond 2.0 (50.8) 4.0 (101.6) S-L 70(294) 58(400) 16(20) 0.241(6.1) Bond 0.5 (12.7) 1.0 (25.4)	-	4		T-1.	70(294)	71(490)	29(32)	0.417(10.6)	SIN		12.7)		3.5 (12.7)	
B,(b) [-1. 70(294) 65(448) 25(27) 0.370(9.4) Bend 0.75 (19.1) 1.5 (38.1) (2.10) L-f 70(294) 64(441) 30(33) 0.549(15.9) Bend 2.0 (50.8) 4.0 (101.6) (2.10) C.10 (2		۳.	8, (b)	L-T	70(294)	71(490)	28(31)	0.389(9.9)	Esnd		19.:)	1.5 (38.1)	:	7
C,(b) L-f 70(294) 64(441) 30(33) 0.549(13.9) 3end 2.0 (50.8) 4.0 (101.6) T-L 70(294) 52(400) 24(26) 0.428(10.9) Bend 2.0 (50.8) 4.0 (101.6) S-L 70(294) 58(400) 16(20) 0.241(6.1) Bend 0.5 (12.7) 1.0 (25.4)	-	6	8, (b)	1-1	70(294)	(2(118)	25(27)	0.370(9.4)	Bend	0.75 (1.5 (38.1)	•	
T-L 70(294) 52(400) 24(26) 0.428(10.9) Bend 2.0 (50.8) 4.0 (101.6) S-L 70(294) 58(400) 15(20) 0.241(6.1) Bend 0.5 (12.7) 1.0 (25.4)	_ 4	ei.	C, (b)	I	70(294)	64(441)	30(33)	0.549(13.9)	Bend	2.0		(9'101' 0'1	i	
70(294) \$8(400) 15(20) 0.241(6.1) Bond 0.5 (12.7) 1.0 (25.4)	=	۲.		T-L	70(294)	58 (400)	24(26)	0.428(10.9)	Bend	2.0		(9'101) 0'1	;	
				S-L	70(294)	58(400)	16(20)	0.241(6.1)	Bend	0.5	12.7)	1.0 (25.4)	;	
						HLAT TREATML	N.							
HLAT TREATMLYT	-1	체	Si Fe	딁	되	1. Solution	Treated 830F (717K	O; Aged 5 Days	s at Re	om Temp	.; 240	: (389K), 48	귶	
다 가 돼 집 중 됐		3N 3.3N 57 3.48 60 3.55	0.3M 0.10 0.10 0.10 0.10	tM 0.2N 18 0.18 16 0.17	0.18N 0.1M 0.14 0.03 0.15 0.02		>28							
SÍ FC Mn CT Ti 1. 0.3M 0.4M 0.2N 0.18N 0.1M 0.11 0.18 0.18 0.14 0.03 0.10 0.16 0.17 0.15 0.02														

ALUMINUM, Zn-Mg-Mn Alloys: DTD 5024 and DTD 5394

Table 5.1

大学は他のは一般のないないないないできないからいからなっています。 ままし しょうしゅうしゅう

		Compo-				Typical	/Krc\ ²		Ŝ	Specimen		
		Heat Treat	Heat Test Treat- Orienta-	Temp F	Yield Strength	NST. (52 -3)	$\left(\frac{2.5}{\sigma_{ys}}\right)$	ۇ چ	Thickness	Midch in (m)	Crack Length	Ref.
odmo i	Fig.		Cron	•	AST (PSV) III)	/ און און אזכא ווד אז כא	(mm)			· · · · ·	ì	
DTC 5024	5024											
ž	Forging: 6 x 6	Α,1	T-S	70(294)	68(471)	19(21)	0.195 (5.0)	(a)	:	;	i	74
	152 x 279 ma)		S-L	70(294)	70(485)	15(16)	0.115 (2.9)	(a)	:	;	;	
À	Forging: 6 x 6 x 4 in (152 x 152 x 102 mm)	۸,1	1-1	70(294)	63(435)	18(20)	0.204 (5.2)	(a)	:	:	:	
DTD 5094	5094						-					
ŝ	Forging:	В,	۲	70(294)	61(421)	24(26)	0.39 (9.9)		Dend 0.32 (8.0) 1.5 (38.1)	1.5 (38.1)	0.32 (3.1)	62
			Ļ	70(294)	60(414)	22(24)	0.33 (8.4)		Bend 0.32 (8.0) 1.5 (38.1)	1.5 (38.1)	0.35 (8.9)	
			S-	70(294)	50(400)	14(15)	0.15 (3.8)		Bend 0.32 (8.0) 1.5 (38.1)	1.5 (38.1)	0.32 (8.1)	
3	and the second s	, e. 3.										

(a) Specimen in accordance with ASTM Recommendations.

COMPOSITION

Cu Mg Si Fe Mn Zn Cr Ni Pb A 0.5N 2.7N 0.5M 0.5M 0.5N 5.7M - 0.1M 0.05M B 0.5N 2.5N - 0.5N 5.5M 0.7M -

HEAT TREATMENT

859F (733K), Nater Quenched at 211F (373K); Aged 275F (408K)

r																	
		Ref.		61	39				112	62							
		Crack Length in (mm)		1.0 (25.4)	1.0 (25.4)	1.0 (25.4)	0.5 (17.7)	1.0 (25,4)	0.75(19.0) 112	0.48(12.2)							
	Specimen	Widzh in (mm)		2.9 (50.8)	2.0 (50.8)	2.0 (50.8)	1.0 (50.8)	2.0 (50.8)	1.5 (38.1)	1.4 (35.6)							
	Spe	Thickness in (see)		1.0 (25.4) 2.9 (50.8) 1.0 (25.4)	1.0 (25.4) 2.0 (50.8) 1.0 (25.4)	Bend 1.0 (25.4) 2.0 (50.8) 1.0 (25.4)	Bend 0.5 (12.7) 1.0 (50.8)	0 (25.4) 2.0 (50.8)	0.75 (15.0) 1.5 (38.1)	Bend 0.38 (9.7) 1.4 (35.6) 0.48(12.2) 62							
		Туре		ដ	ಕ	Bend	Bend	៦	C	Bend							
	/K ₁ C\ ²	$\frac{2.5}{\text{in}} \left(\frac{\sigma_{ys}}{\sigma_{ys}} \right)$		0.9 (22.9)	0.58 (14.7)	0.88 (22.4)	(12.4)	(10.7)	0,24 (6,0)	0.29 (7.4)							
		~		6.0	0.58	0.88	0.49	0.42	0,24	0.29							
	Typical	$KSI\sqrt{In}\left(\frac{1}{MN} \frac{3}{m^{-\frac{3}{2}}}\right)$		36(40)	29(200)	38(42)	26(29)	23(25)	19(21)	25 (28)	,						specifications.
ce aroni		Yield Strength KSI (MN/m ²)		60(414)	60(414)	64(441)	59(407)	56(386)	62(427)	74(510)			티	0.03			alnum Association
		Temp °F (°K)		70(294)	70(294)	70(294)	70(294)	70(294)	70(294)	70 (294)			비		0.13N	1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	e With Alw
		Test Orienta-		r-1	1-L	L-T	1-1	S-1.	C-1	7-L			Mn 2n	0.32 6.25 0.39 6.08	0.25N 6.0N		in accordanc
	Compo	Heat Treat ment		A, (a)		B, (a)			(a)	· .	I		밁	0.19	•		reathont
		Form		Plate: 1.375 in	(54:9 ma) inich	Extrusion: 3.5	III (68.9 ma) f1ck		forging: 4 in (62 mm) Thick			TION	Cu Mg Si	0.92 2.01 0.014 1.12 2.04 0.04	2.5N		(a) rabrication and neat ireatment in accordance with Aluminum Association Specifications.
· House Joseph		1 emper	-080	1221		T751X			1	M-758	È	COMPOSITION		< 6	ပ		(e)

ALUMINUM: 6061

Table 56

Ref. 39 86 0.916(23.3) Bend 1.0 (25.4) 2.0 (50.8) 1.0 (25.4) 111 3.0 (76.2) 0.914(23.2) Bend 1.5 (38.1) 3.0 (76.2) 1.5 (38.1) 1,111(28.2) Bend 1.5 (38.1) 3.0 (76.2) 1.5 (38.1) 3.6 (76.2) 3.0 (76.2) Crack Length in (mm) 1,276(32,4) Rend 3,0 (76,2) 6,0 (152) 3,0 (76,2) 6.0 (152) 3,0 (76,2) 6,0 (152) ridth ın (mm) Specimen Thickness in (mm) Type 1.084(37.5) Bend 0.689(17.5) Bend KSIVin (NE/m 2) Typical KIC 26(28) 30 (33) 30(33) 27(30) 21(23) 23(25) KSI ("IN/m") Yield Strength 40 (276) 58(262) 45 (310) 42(290) 41(283) 43(296) lon, 's 70(294) 70 (294) 70(294) 70 (294) 70 (294) -112(193) Test Orienta-S-T T-1. <u>:</u> 7-1 S-1. Ţ-Ţ Compo-sition, Heat Treat-ment A, (a) ۸, (а) λ, (a) Plate: 3 in (76.2 mm) Thick Plate: 1.5 in (38.1 mm) Thick Forging: 9 in (229 tx) Thick For Temper 1051

(a) Fabrication and Heat Treatment in Accordance with Aluminum Association Standards.

COMPOST FIOR

 COL
 Mg
 Si
 Fc
 Mn
 Zn
 Ti
 Cr

 A
 0.28%
 1.0%
 0.6%
 0.7%
 0.15%
 0.25%
 0.15%
 0.2%

85%

-<u>s</u>

	(mdd)	300 260 0.03		1180 1260 0.16
		Si	VI Ng	Beo Fe
:			_	COMPOSITION
9.0			-	
11.2(12.3) 0.31 (7.8) CT 1.0 (25.4)			•	
9.5(10.4) 0.21 (5.3) CT 1.0 (25.4)				
3.5(9.3) 0.13 (3.2) CT 1.0 (25.4)		'		
8.0(8.7) 0.10 (2.5) CT 1.0 (25.4)	155) 40 (276)	1		
8.3(9.1) 0.10 (2.5) [7 1.0 (25.4)				
7.6(8.3) 0.08 (2.1) CT 1.0 (25.4)			-°2	Hqt Pressed: 11 x 12 x 13 in (279 x 305 x 330 mm)
11(12.1) 0.81 (2.1) Bend 0.5 (12.7)	70(294) 61(421)	70()	- °	Forged: 16 in (406 mm) Dia x l in (25.4 mm) Thick
0.183(4.6) Rend	70(294) 37(255)	70(Α,-	Not Pressed: 30 in (762 mm) Dia x 32 in (813 mm) long
KSIVIn (NIN/m ⁻²)	K)	Orienta- Temp		Form
	Yiold		Compo- sition,	
Table 57	Tab			BEHYLLI JM: S-200
Pypical	(1) (1) (2) (2) (2) (3) (4) (4) (4) (4) (4) (5) (4) (6) (6) (6) (6) (6) (6) (6) (6) (6) (6	1-5st tion 1-1 1 tion 1-1 1 T-1 -3 1 T-1 -3 1 T-1 -3 1 T-1 -5 Compo- ition, Treat- men Men Mg B,- C,- C,-	Form 14: 30 in 15 in (406 mm) Dia : 16: 11 x 12 x 13 in 17: 13 mm) 16: 500 1180 17: 190 1260 17: 190 1260 17: 110 0.16	